THE

POPULAR SCIENCE MONTHLY.

JULY, 1889.

WHAT IS CIVIL LIBERTY?

By W. G. SUMNER,

PROFESSOR OF POLITICAL AND SOCIAL SCIENCE IN YALE COLLEGE.

IT might seem that liberty was one of the most trite and worn of all subjects. It will be the aim of this paper to show that liberty is the least well analyzed of all the important social conceptions, that it is the thing at stake in the most important current controversies, and that it needs to be defended as much against those who abuse it as against those who deride it.

In the first place, I put together some citations which will, I think, justify me in bringing this subject forward again:

1. Rodbertus is the one of the recent socialists with whom it is best worth while to deal, for he is the master of them all. He is also best understood in his writings on Roman taxation, in which his historical text and his social dogmas throw important light on each other. He defines liberty to be a share in the power of the state.* He then defines "free trade," in the following pages, so as to make it cover all civil liberty, according to Anglo-American institutions, and attributes to "free trade," in this sense, no less harm than the destruction of civilization. It is amusing to notice how this denunciation of free trade, which it would have been so satisfactory for the opponents of free trade to quote, has been fenced off and marked with the strongest kind of a danger-signal, so that it is never quoted at all, because it is an assault on all modern liberalism as broad as the Pope's "Encyclical" of 1864. In fact, this parallelism must be noted more than incidentally, for it helps to show what I here have in view: that all forms of liberty are *solidaire* with each other, and all forms of assault on liberty, as well the revolutionist and socialistic as the extreme reactionary, are

* 5 Hildebrand's "Jahrbücher," 269.

also *solidaire* with each other. A criticism of Rodbertus is a task which I reserve for another occasion, but, as germane to my present subject, I ask attention to the following proposition, as illustrating the sort of dogma which shows the need of re-analyzing liberty: "Moral freedom is conditioned on historical necessity." Some of our contemporaries take that sort of proposition as the profoundest wisdom. To me it is oracular in more senses than one.*

2. From a large collection of similar cases I select the following: "Life appears to the Manchester party to run its course under the form of a parliamentary debate, and not otherwise. An assertion is followed by an objection, this by a rejoinder, and so on. The decision of the majority is final." The view here stigmatized is held by all those who believe in government by deliberation. "The great affair in this world is, not to convince a man's intelligence, or to increase his knowledge, but it is at least equally important to lead his will and to *conquer* it." † The writer goes on to argue that, if men are allowed to act freely, they will not act by deliberation, but selfishly. There he leaves the matter, apparently believing that he has routed the "Manchester Schule," and established something of philosophical or practical importance. He must, of course, assume that himself and his friends are to decide when others and their friends are acting selfishly, and ought to have their wills conquered.

3. To take another citation from a popular writer: "Not one liberal principle but is admirable in the abstract; yet not one liberal measure that has not worked terrible mischief in our time. The liberty of thought, for instance; who dare gainsay it? Yet it has proved destructive of the principle of religion, without which there is less cohesion among men than among a herd of swine. The liberty of settlement and circulation has given rise to the pestilence of large towns, in which men congregate and live together on terms worse than a pack of wolves. The liberty of industry has reduced four fifths of the population to a state of serfdom more cruel than negro slavery, while more than half of the remaining population is engaged in a perpetual struggle, more savage than the intermittent warfare of cannibals. Free trade among nations has ruined, first individually, then industrially, then financially, and finally politically, prosperous countries, such as Turkey, while in England it has destroyed, not only agriculture, but all those sterling qualities which formerly characterized British industry and trade. . . . Parallel to the deception experienced by the modern world through the progress of industry, aided by discovery and invention, have come down on this genera-

* 8 Hildebrand's "Jahrbücher," 420, note.

† Von Eichen in "Preuss. Jahrbücher," 1878, p. 382.

tion the fatal effects sprung from the spread of education. While thoughtless or superficial writers pretend to find in education the remedy of all social evils, as a matter of fact education has become the source of a vast amount of human suffering in modern times, under which those whose education is their only patrimony or source of income suffer most."* This is sufficiently explicit, and also manifests the solidarity of all forms of liberty and modern civilization. Those who attack them all show that they appreciate the truth of things a great deal better than those who try to attack some and save others.

4. Then there are the philosophers of the newest school, who, seizing upon the plain fact that all liberty is subject to moral restraints, as we shall presently see, are forcing upon us, or trying to force upon us, by legislation, restraints on liberty derived from altruistic dogmas, and, in general, under the high-sounding name of ethics, are assuming a charter for interference wherever they choose to allege that they have moral grounds for believing that things ought to be as they want them.

5. Finally, the anarchists, taking liberty to mean that a man ought to be a law unto himself, and that there should be no other law, have shown from another side that we should try to find out what liberty is.

THE HISTORY OF THE DOGMA OF NATURAL LIBERTY.—The history of the dogma of the natural liberty of all men, with the cognate dogma of the natural equality of all men, would be an important topic for exhaustive treatment by itself. From the notes which I have made on the subject I condense as far as possible the following view of it:

Slavery in the classical states seems to have rested upon the law of war, that the vanquished man with his family and all his property fell under the good pleasure of the conqueror. Xenophon states this law explicitly: "The law is well known among all men that, when a state goes to war, the property and bodies of all in the state are the property of the captors. You will, therefore, not possess wrongfully whatever you get, but, if you permit them to retain anything, it will be out of humanity."† It seems that the reason why slaves in antiquity so universally accepted their fate was that they understood that such was the fortune of war. They acquiesced in it as according to the rules of the game. The earliest writer in date whom I have found who utters the dogma of liberty is Philemon (fl. c. 350 B. C.): "No one by nature ever was born a slave, but ill-fortune enslaved the body."‡ Aristotle discusses the subject in the third and fourth chapters of the first

* Karoly, "The Dilemmas of Labor and Education," London, 1884, introd., x.

† "Kyroped.," vii, 5, 73. Cf. "Memorab.," ii, 2, 2, and Polybius, ii, 58, 9.

‡ Frag. 39 in Meineke, "Com. Graec.," iv, S. 47.

book of the "Politics." He says that some held that slavery was against nature. Such persons, whoever they were, must have derived their opinions entirely from humane impulse and poetic enthusiasm. Aristotle was not of that tone of mind. He could not find in history any example of a state which had not slavery. When he examined the state in which he lived he easily saw that slavery was of its very essence. He therefore held that slavery was a natural necessity. Such it was in the sense that it was rooted in the nature of the classical state. It is undeniable that the classical state could not have grown up and could not have produced its form of civilization without slavery. It must also be recognized as a fact that no other organization of society has yet shown itself capable of that degree of expansion which the Roman state developed by means of slavery. The mediæval state broke down under the first expansive requirement which was made upon it. Whether the modern state, based on natural agents and machinery, is capable of expansion or not, is yet to be proved. There seems to be ample reason to believe that it is, unless the modern world votes not to go on; but, if the modern world votes to go on and not be afraid, it can only do so by virtue of education, and then it is subject to the remonstrance of Mr. Karoly at the head of this article, and of others who think like him. To return to the classical state: it remains only to observe that slavery was likewise the fate of that state which, having enabled it to grow up to immense power and achievement, also inevitably carried it down to ruin and disgrace. It is free to us all to speculate on the question whether every force which makes high expansion possible will not also bring with it its own form of inevitable destruction or decay. Aristotle, therefore, proceeding upon the historical method and upon observation, found that slavery was necessary and expedient within the limits of the age and the form of society he was discussing.

Fuller expression of the dogma of natural liberty comes only with the Christian era. Dio Chrysostom, at the end of the first century, expresses himself in favor of it, but his declaration is incidental and can be taken only as rhetorical.* It is among the Christian writers that it first finds distinct and enthusiastic expression. With them it is rather an inference from fundamental doctrines of the faith than an actual article of the creed, although they quote texts freely in support of it. The doctrines of Christianity are undoubtedly favorable to it, and the inference was direct and easy. Tertullian (fl. c. 200 A. D.), addressing heathen, declares, "We are your brothers by the right of one mother—Nature."†

It was not confined to Christians, however. It is very probable

* "Orat.," vii, 138.

† "Apologet. ad Gent.," c. 39.

that it may have entered into the Stoic philosophy in some vague way. We find it in the lawyers of the third century. Ulpian says: "In civil law, slaves are considered null. Not, however, by natural right; because, as regards natural right, all men are equal."* And Florentinus: "Liberty is the natural faculty of that which it is permitted to any one to do, unless something has been prohibited to him by force or law. Slavery is an institution of the law of nations, by which any one is subjected to the rule of another, against nature. *Servi* are so called because military commanders are wont to sell captives, and so to preserve (*servare*) them and not kill them." † The doctrine, therefore, gets into the Institutes of Justinian: ‡ "Slavery is the institute of the law of nations by which a human being is subjected to another's control against nature." These propositions, however, in the law, remained entirely barren, and were not different from the academical utterances of the philosophers. It was the voice of reason and conscience recognizing a grand abstract doctrine, but without power to solve the social problems which would arise if that doctrine should be in any measure admitted into the existing order. The Christians alone seem to carry on the doctrine as something more than a pious hope, something not more distant than any other feature of the kingdom of heaven, and easily realizable in that kingdon. The vague elements of social and political innovation in the revolt of the Donatists and the Bagaudes bear witness to the extent to which some such doctrines had been popularized. The latter had a very *naïve* definition of natural rights, and, on the whole, as good a one as has ever been given: "Natural rights are born with us, *about which nothing is said.*" *

By the seventh century, the churchmen had made the doctrine of natural liberty one of the tenets of the Church. Gregory the Great writes: "Since our Redeemer, Creator of all creatures, deigned to put on human form, in order by his divine grace to break the bonds of the servitude by which we were held as captives, that he might restore us to our ancient liberty, it is fitting and advantageous that those whom Nature has made free, and whom the law of nations has made subject to the yoke of servitude, should be restored, by enfranchisement, to that liberty in which they were born." ‖ This passage became authoritative for the middle ages, as well for the point of view of the doctrine, and the sanction of it, as for its substance. It is a familiar fact that

* "Digest," I, 17, 32. † "Digest," v, 4. ‡ I, tit. iii, 2.

* See Jung, Sybel's "Zeitschrift," xlii, 65. He gives no authority for the definition of natural rights. Another topic which might be investigated with great advantage to social science is the history of popular revolts, with especial attention to their common elements of political and social dogma.

‖ Epistles, book vi, ep. 12; 77 Migne, 803.

the current reason then alleged for enfranchisements was one's soul's health in the realization of a high Christian ideal. About 825 Bishop Jonas, of Orleans, asks: "Why are not master and slave, rich and poor, equal by nature, since they have one Lord in heaven, who is not a respecter of persons? . . . The powerful and rich, taught by these [church fathers], recognize their slaves and the poor as equal to themselves by nature."* In the twelfth century Bishop Ivo writes: "If we consult the institutes of God, and the law of nature, in which there is neither bond nor free," etc.† In the thirteenth century the doctrine appears in Bracton.‡ When describing the classes of men as free, villains, serfs, etc., he says: "Before God, there is no acceptance of men as free, or of men as slaves." Here we see the doctrine, such as the churchmen had been elaborating it, with its scriptural warrant, pass into the English common law.

In the fourteenth century the kings of France, in enfranchising the communes on the domains, repeatedly allege this doctrine as one of their motives.# Undoubtedly, the real motive was that more revenue could be got from them by taxing them as communes than by exacting feudal dues from the members as serfs, but it all helped to spread the doctrine as an idea of what would be "right."

This review now shows that the doctrine of liberty and equality by "nature," by birth, and by natural right was not by any means an eighteenth-century dogma. It had been growing and spreading for eighteen hundred years. It had begun in skepticism about the fairness of slavery. It could not begin with anything else. It went on until it became a philosophical notion of liberty, meaning the natural right of every one to pursue happiness in his own way, and according to his own ideal of it. It could not stop short of that.

This dogma did not emancipate slaves or serfs. During a thousand years, from the sixth to the sixteenth century, the peasants of France and England passed through the stages of slavery, serfdom, villainage, and compulsory settlement,‖ by persistent struggles of their own, aided by economic improvements and po-

* "De Instit. Laic.," ii, 22; 106 Migne, 213. He quotes Coloss. iv, 1.

† Epist. 221; 162 Migne, 226.

‡ Book i, ch. 8, ed. Twiss, 1878.

The originals of these documents are not accessible to me. One of Philippe le Bel is quoted: "Seeing that every creature who is formed in the image of our Lord ought, in general, to be free by natural right," etc.; and one by Louis le Hutin: "Seeing that, by the right of nature, each one ought to be born free," etc.

‖ In September, 1860, the correspondent of the "Augsbürger allgemeine Zeitung" wrote from New York that the correct solution of the American slavery question would be to determine upon five steps: 1, forbid separation of negro families; 2, bind the slaves to the soil; 3, change them into serfs; 4, change serfdom to villainage; 5, abolish the last. (Quoted by Rodbertus, with approval, 2 Hildebrand's "Jahrbücher," 266.) This is as

litical vicissitudes, but the dogma of natural rights was aiding them all the time, by undermining the institutions of the law, and by destroying the confidence of the ruling classes, so far as they were religious and humane, in the justice of the actual situation.

Therefore the most important fact in regard to the history of the dogma of natural liberty is that *that dogma has never had an historical foundation*, but is the purest example that could be brought forward of an out-and-out *a priori* dogma; that this dogma, among the most favored nations, helped and sustained the emancipation of the masses; and that, by contagion, it has, in the nineteenth century, spread liberty to the uttermost parts of the earth. At no time during this movement could anybody, by looking backward to history, have found any warrant for the next step to be made in advance. On the contrary, he would have found only warning not to do anything. Such must always be the effect of any appeal to history, as to what we ought to do, or as to what ought to be. It is a strange situation in which we find ourselves, when those of us who are most unfriendly to "metaphysics," and have most enthusiastic devotion to history, find ourselves compelled to remonstrate against half-educated denial of what speculative philosophy has done and may do for mankind, and also to remonstrate against the cant of an historical method which makes both history and method ridiculous. To go off and begin to talk about history, in the crisis of a modern discussion, is the last and best device of reaction and obscurantism.

Let it be noticed also that from our present standpoint this doctrine has lost nearly all the arguments which were ever brought to its support. The notion of natural rights is not now held by anybody in the sense of reference to some original historical state of the human race. The biblical scholars would scarcely avow the exegesis by which the doctrine was got out of the Scriptures. The dogma to-day does not stand on the ground of an inference from any religious doctrine. The doctrine of evolution, instead of supporting the natural equality of all men, would give a demonstration of their inequality; and the doctrine of the struggle for existence would divorce liberty and equality as incompatible with each other. The doctrine, thus stripped of all the props which have been brought to its support, would remain only a poetic inspiration; but, if all this is admitted, if its historic legitimacy is all taken away, does that detract anything from the beneficence of the doctrine in history, or render invalid a single institution

refined and beautiful an application of the "teachings of history" as could possibly have been made to that case, yet it requires very little knowledge of the case as it really stood to see that this programme was as unpractical and pedantic as the wildest proposition which could have been made by an *a priori* philosopher.

which rests upon it now? Shall we any of us return into serfdom, because it is proved that our ancestors were emancipated under a delusion or a superstition?

On the other hand, it is when we turn to the present and the future that the rectification of the dogma becomes all-important. The anarchists of to-day have pushed the old dogma of natural liberty to the extremest form of abstract deduction, and they propose to make it a programme of action. They therefore make of it a principle of endless revolution. If, however, the basis on which it once rested is gone, it is impossible that we should hold and use it any more. With our present knowledge of history, we know that no men on earth ever have had liberty in the sense of unrestrainedness of action. The very conception is elusive. It is impossible to reduce it to such form that it could be verified, for the reason that it is non-human, non-earthly. It never could exist on this earth and among these men. The notion of liberty, and of the things to which it pertains, has changed from age to age even in modern history. Never in the history of the world has military service weighed on large bodies of men as it does now on the men of the European continent. It is doubtful if it would ever have been endured. Yet the present victims of it do not appear to consider it inconsistent with liberty. Sumptuary laws about dress would raise a riot in any American State; a prohibitory law would have raised a riot among people who did not directly resist sumptuary laws. A civil officer in France, before the Revolution, who had bought or inherited his office, had a degree of independence and liberty in it which the nineteenth-century official never dreams of. On the contrary, the more this nineteenth-century civil and political liberty is perfected, the more it appears that under it an official has freedom of opinion and independence of action only at the peril of his livelihood.

So far our task has been comparatively easy. It requires only industry to follow out the history of what men have thought about anything. To find out how things have actually taken place in the life of the human race is a task which can never be more than approximately performed, in spite of all our talk about history. To interpret the history is still another task, of a much more difficult character.*

LIBERTY IN HISTORY AND INSTITUTIONS.—We are blinded by the common use of language to the fact that all social actions are attended by reactions. To take the commonest and often noticed

* The Emperor Paul, of Russia, showed what may be done in the interpretation of history. When he heard of the excesses of the French Revolution, he turned to his sons and said, "Now you see that it is necessary to treat men like dogs" (Masson, "Mémoires sur la Russie," 219). It is true that he was crazy, but we all have our personal limitations, which are most important when we undertake interpretation.

instance: We talk of buyers and sellers, as if they were independent of each other. We call those who have money buyers, and those who have goods sellers. We find, however, that no transaction can be correctly understood until we regard it as an exchange, having two parts, an action and a reaction, equal and opposite. In the language of the market, also, we speak of being long or short of the market, but every one who has either money or goods is in the market, and is both long and short of it all the time. He is either long of goods and short of money, or long of money and short of goods. The philosophy of the market can not be understood unless we study it from this point of view.

The fallacy of a great many doctrines in social science, and the philosophy of a great many errors in social policy, is that they divorce the action from the reaction. If there is not a reaction with equivalence and equilibrium, then there is an expenditure from one side toward the other, a drain of force from one side and an accumulation of it at another, until there come a crisis and a redistribution. When the return and equivalence are suspended, there is a necessary continuance of the movement, in the tendency toward a stable equilibrium of another kind, which would come about when all the force had been transferred. For instance: You give good schools for less than their market value; you must, then, give free schools; then you must give free books and stationery; then "hot breakfasts,"* and so on in succession. The fact that one thing has been given is made an argument for more. You are told: You have established free schools; "why should not you" do whatever else the proponent favors. The argument that, because you have given a man one thing, you ought to give him another, is not good in logic, but it is intensely strong in human nature and in history. The saying is attributed to Danton, the revolutionist: "The revolution came, and I and all those like me plunged into it. The *ancien régime* had given us a good education, without opening an outlet for our talents." The great fallacy of socialistic schemes is that they break off the social reaction. A man is to have something simply because he is a man—that is, simply because he is here. He is not to be called upon to render any return for it, except to stay. On the other hand, the tax-payer, who has provided all there is, is not on that account to be entitled to a recompense of any kind. He has only incurred a new liability—viz., to do the next thing which is demanded of him. The only stable equilibrium under this system would be universal contentment. But bounty does not lead to contentment, and can not, until the recipient has everything for nothing. The movement, therefore, runs to a crisis, a redistribution, a re-

* "The Economist," 1889, p. 430

commencement. The further it goes, the further it approaches anarchy, impoverishment, and barbarism.

At various times, in primitive society, in ancient Egypt, and in the Roman Empire, when women have possessed the forces which were efficient in the society, they have had dominion over men. They abused the power when they had it, too. At other times the subjection of women has been due to the fact that they have needed protection. They did not possess the forces which, at the time, were required for self-defense in the society. Since they accepted protection, they could not be free. When they fell into dependence, they could not be independent. If they could claim protection, and at the same time dominion, they would be privileged; and any one who enjoys privilege, which some one else has to furnish, is of course superior. Hence, there are three positions only in social relations: servitude with inferiority, privilege with superiority, and a middle state of neither, with equality.

Peasant proprietors turn into colons and serfs through misery.* They abandon personal liberty in order to get protection, and they accept servitude to get security, because they find that they have not enough of the force which prevails in the society to defend themselves. Their lords maintain superiority and exact for themselves social privilege. Such was the course of things at the downfall of the Roman Empire. When things began to improve in western Europe, the slave thought that it was comparative freedom when he was bound to the soil, because his family could not be separated, and he could not be removed from his home. A villain, however, would have thought it slavery to be reduced to the status of the serf, with unlimited servitudes to render. The serf, in his turn, thought it immeasurable gain to get his servitudes made definite, although a free man would have thought it slavery to be reduced to villainage. A villain could not go if he wanted to, but he could not be evicted if any one wanted to send him away. A free man can go if he wants to, and may be evicted if the other party chooses. At what point does the servitude of the villain, who must stay and work and pay feudal dues, turn into the blessing of the free tenant, who has fixity of tenure, but works and enjoys, subject to taxes? Evidently it is at that point where the rights and benefits of holding and using become equal to the burdens and duties of taking and using—always with reference to the comparative value of other chances which present themselves. If a villain wants to stay, it is a privilege that no one can evict him; if he wants to go, it is a servitude that some one can retain him. If the landlord wants to force tenants to stay and till his land, it is a privilege for him to be able

* This is a disputed point, on which a great deal has been written, with very great divergence of opinion. The above seems to me to be the best opinion.

to force them to stay.* If the landlord wants to turn his land to other use, it is a servitude for him if he can not evict his tenants. The modern peasant proprietor is one in whose status all these privileges and servitudes have met, coalesced, and disappeared, so that they are all summed up in the question whether his land is worth holding and tilling, subject to the taxes which must be paid on it.

In all these variations and mutations of social status and of the relations of classes, which we might pursue with any amount of detail through the history of the last fifteen hundred years, where is there any such thing as personal liberty of the sort which means doing as one likes? None have had it but those who were privileged—that is to say, it has lain entirely outside of civil liberty. It has had the form of an artificial social monopoly, and the fact has come out distinctly that liberty to do as you please in this world is only possible as a monopoly, but that it is the most valuable monopoly in the world, provided you can get it as a monopoly. You would realize it when you got into the position of Nero, or Louis XIV, or Catharine II.

We may gather some other cases in point.

A man who expects to go to the almshouse in his old age may regard a law of settlement as his patent of security, because it defines and secures his place of refuge. A man who is in the same status, but who is determined to better his condition by energy and enterprise, tries to move. He finds the law of settlement a curse, which may hold him down and force him to become a pauper.

If you are not able to make your own way in the world, you want to be protected by status. If you have ambition and ability to make a career for yourself, you find that status holds you down. In the former case it holds you up, or keeps you from falling; in the latter it holds you down, or keeps you from rising. On the whole, therefore, it keeps the society stagnant. If numbers do not increase very much, there may not be much suffering. If numbers do increase, there will be mendicancy, pauperism, vagabondage, and brigandage. It is a matter of great surprise that so little investigation has been expended on the vagabondage of the middle ages. The students of that period have kept their attention on those who were inside of its institutions. The test of the mediæval system is to be found in a study of those who were kept out of its institutions.

If it is a mark of a free man, as in early Rome, to do military duty, every one may regard that function as a right or privilege, rather than as a burden or duty. It may carry with it privileges

* It was so in Denmark in the last century. See Falbe-Hansen, "Stavnsbaands-Lösningen," and the "Nation," 1889, p. 123.

of citizenship which make it worth more than it costs. If, however, the privileges of citizenship are lost and the burden of military duty increases, men will, as in the dark ages, sacrifice personal liberty as well as civil liberty in order to get rid of military duty. If, as in Russia, at least formerly, the privileges of citizenship are *nil* and the burdens of military duty very heavy, to be taken as a soldier is like incurring a capital sentence.

If a man enjoys a position of advantage compared with others, he is anxious to entail it on his children. If he is under shame or disadvantage, he is anxious to break the entail. One who is born of a duke is anxious to maintain hereditariness, but one who is born of the hangman rebels against it. The two were part of one system, and, in the long run, must stand or fall together.

He who is not able to attain to his standards of happiness by his own efforts is one of the "weak." He does not want to be let alone. He wants some one to come and help him. He who is confident of his own power to accomplish his own purposes, wants to be let alone; he is "strong" and resents interference. In the long run, however, he who may be called upon for aid in the former case will insist on his right to interfere in the latter case, and he who claims freedom in the latter case will find that he must bear his own burdens in the former. Any other course would simply lead to a new system of privilege and servitude, for he who can choose his own ends and make somebody else help him attain them has realized privilege in its old and ever-abiding sense.

Privilege and servitude, therefore, are the poles between which all forms of social status lie when we classify them with reference to our present study. Rights lie on the side toward privilege. Duties lie on the side toward servitude. Rights and duties, however, are not separated by any gulf nor even by a line. They overlap each other. Not only are they parallel and connected by the social reaction, but also often to different men or at different times the same thing presents itself either as a right or a duty, e. g., military duty. Somewhere between, however, lies *the middle point or neutral point, where there is neither privilege nor servitude, but where the rights and duties are in equilibrium, and that status is civil liberty* in the only sense in which it is thinkable or realizable in laws, institutions, and history.

We have seen cases above in which the same men were under privilege and servitude at the same time, having accepted one as the price of the other. We have also seen cases in which the privilege of some involved the servitude of others. The former class of cases have been those which have had the most unhappy issue, for the privileges have often faded with time and the servitudes have been intensified. It is a bargain which a rational being can rarely afford to make, to incur servitude in the hope of privilege.

Herein lies the curse of socialistic schemes when viewed from the side of the supposed beneficiary. They are a bait to defraud him of his liberty. I do not see how the German accident and workman's insurance can fail to act as a law of settlement, thereby, under a pretense of offering the workman security, robbing him of his best chance of improving his position. Still, the cases where a man incurs his own servitude for the sake of his own privilege are not as bad in some respects as those in which some have privileges for which others bear servitudes.

The modern jural state, at least of the Anglo-American type, by its hostility to privileges and servitudes, if not by direct analytical definition of its purpose, aims to realize the above definition of liberty. It is the one which fills our institutions at their best, and the one which forms the stem of our best civil and social ideals. If all privileges and all servitudes are abolished, the individual finds that there are no prescriptions left either to lift him up or to hold him down. He simply has all his chances left open that he may make out of himself all there is in him. This is individualism and atomism.* There is absolutely no escape from it except back into the system of privileges and servitudes. The doctrine of the former is that a man has a right to make the most of himself to attain the ends of his existence. The doctrine of the latter is that a man has a right to whatever he needs to attain the ends of his existence. If the latter is true, then any one who is bound to furnish him what he needs is under servitude to him.

The fact, however, is rapidly making itself felt that this civil liberty of the modern type is a high and costly thing. A generation which has been glorying in it and heralding it to all the world as a boon and a blessing, to be had for the taking and to be enjoyed for nothing, begins to cry out that it is too great for them; that they can not attain to it nor even bear it; that to be a free man means to come up to the standard and be it; and that it is asking too much of human nature. They want somebody to come and help them to be free. It has always been so. Men have failed of freedom not because kings, nobles, or priests enslaved them, but because liberty was too high and great for them. They would not rise to it. They would submit to any servitude rather. Therefore they got servitude.

The strain of civil liberty is in the demand which it makes on the whole mass of the people for perpetual activity of reason and conscience to re-examine rights and duties, and to readjust their equilibrium. Civil liberty is not a scientific fact. It is not in the

* The writer of an otherwise good book (Rauber, "Urgeschichte des Menschen," ii, 291, fg.) indulges in an extraordinary screed against the atomists. He reaches the conclusion that fate is the state. To me it seems that fate is one's father and mother.

order of nature. It is not positive and objective; therefore it is not capable of constant and easy verification. It is historical and institutional. That means, however, that it is in the flux and change of civilization, wherefore the reason and conscience of men are kept in constant activity to re-examine accepted principles, and to reach new and more correct solution of problems. On account of this activity, institutions are modified constantly, and the concrete contents of the public creed, about rights and duties, are undergoing constant change. It does not appear that this ever can be otherwise. There is an assumption that we can attain to social stability by finding out the right "form of government," or the correct "social system," but no ground for such a notion can be found in philosophy or history.* *The equilibrium of rights and duties constitutes the terms on which the struggle for existence is carried on in a given society*, after the reason and conscience of the community have pronounced judgment on those terms. The very highest conception of the state is that it is an organization for bringing that judgment to an expression in the Constitution and laws. A state, therefore, is good, bad, or indifferent, according to the directness and correctness with which it brings to an expression the best reason and conscience of the people, and embodies their judgment in institutions and laws. The state, therefore, lives by deliberation and discussion, and by tacit or overt expressions of the major opinion.

The fact that laws and institutions must be constantly remolded, in the progress of time, by the active reason and conscience of the people, is what has probably given rise to the notion, just now so popular, that ethical considerations do, or ought to, regulate legislation and social relations. The doctrine, however, that institutions must, in the course of generations, slowly change to conform to social conditions and social forces, according to the mature convictions of great masses of men, is a very different thing from the notion that rights and duties should be at the sport of all the crude notions which, from time to time, may gain the assent of even an important group of the population.

Among the most important tides of thought at the present time which are hostile to liberty are *socialism*, which always has to assume a controlling organ to overrule personal liberty and set aside civil liberty, in order to bring about what the socialist authorities have decided shall be done; *nationalism*, really a cognate of socialism, with opposition to emigration or immigration; *state*

* One of the most remarkable signs of the confusion reigning in social science is the fact that current discussion is marked by an attempt to force positive character upon the doctrines of the state, or to make a science of "political science," which never can be anything but historical and institutional, and at the same time to deny scientific character to economic laws, and to insist that they are historical and institutional.

absolutism, which, in its newest form, insists that the individual exists for the state; and *altruism*, which, when put forward as an absolute dogma, is as anti-social as selfishness. These all are only the latest forms of the devices by which some men live at the expense of others. In their essence and principle they are as old as history, and not even the device of making the victims vote away their own liberty, apparently of their own free will, because they think they ought to do so, has anything new in it.

A STUDY OF SUICID

By CHARLES W. PILGRIM, M.D.

AS the love of life is generally acknowledged to be the strongest instinct of the human mind, it is but natural that the subject of voluntary death should have attracted, at all times, a great amount of attention from moralists and sociologists.

Some of the noblest men and women of ancient times advocated and practiced self-destruction, and the frequency of the act in our own day demonstrates that the fear of death is by no means general. Prof. Mayer, of Paris, in a lecture on this subject, declared that every one of his hearers had, at some time, thought favorably of committing the deed. He challenged contradiction, but no one responded.

This longing for "restful death," which comes to nearly all of us sooner or later, can usually be resisted; but often the desire is so great that the will is not strong enough to overcome it, and another name is added to the long list of suicides which statistics show us is increasing with terrible rapidity.

Very exhaustive statistics in regard to this subject have been compiled by Profs. Bertillion and Morselli, and they both arrive at about the same conclusions. Taking each million of inhabitants, the following results were obtained: In Austria the number was increased between 1860 and 1878 by from 70 to 122 annually; in Prussia, between 1820 and 1878, by from 71 to 133; in the smaller German states, between 1835 and 1878, by from 117 to 289; in France, between 1827 and 1877, by from 52 to 149, the greater proportion being in the larger cities. Peasants rarely commit suicide, statistics showing that in Belgium, where laborers can generally find employment, the increase between 1831 and 1876 was only from 39 to 68. In Sweden and Norway about the same result was obtained, viz., an increase from 39 to 80 per year during the same period. Italy, Spain, and Ireland show the lowest number, the increase between 1864 and 1878 being only from 28 to 35 in the former, while in Spain and Ireland it was still less, the latter show-

ing an increase of but from 14 to 18 per year during the same period. This result is probably due to a great extent to the influence of the Catholic priesthood, for it is the Roman Church, above all others, that has firmly "fix'd its canon 'gainst self-slaughter."

On account of the more settled social condition of England the statistics of that country do not show the same alarming increase as those of France, Germany, and Austria, but the regularity of the number for each five years, from 1855 to 1875—viz., from 1855 to 1860, 65; from 1860 to 1865, 66; from 1865 to 1870, 67; and from 1870 to 1875, 66—supports in a remarkable degree the statement made by Buckle that, "when the social conditions do not undergo any marked change, we find year by year the same proportion of persons putting an end to their existence, so that we are able to predict, within a very small limit of error, the number of voluntary deaths for each ensuing period."

Both Profs. Bertillion and Morselli express some doubt as to the reliability of their statistics showing an increase in the United States on account of its rapidly increasing population; but any one who will pay attention to the subject will be convinced, I am sure, that a marked increase is annually taking place; and there are many reasons why it should be so. Our country is young, social changes are rapid, and the struggle for wealth is severe. In brief, we are living in what is justly called a "fast age." The modern youth "consumes in an hour, by useless brilliancy, the oil of the lamp which should burn throughout the night," and soon finds that the infirmities of age have supplanted the vigor of youth; the business man who to-day is at the very height of prosperity, by some rash speculation becomes a bankrupt to-morrow; the professional man, who is ambitious of distinction, does not rest when the sun goes down, but prolongs his work far into the quiet hours of night. In fact, almost every one is madly pursuing either pleasure, wealth, or fame, and, under such circumstances, is it a wonder that often an overpowering sense of *ennui* and disgust of life occurs, or that the delicate structure of the brain breaks down, impelling the unfortunate victim to seek rest in the suicide's dishonored grave?

Besides dissipation, reverses of fortune and overwork, love, jealousy, and remorse play an important part in the etiology of self-destruction. Marc Antony fell upon his sword and killed himself because he believed that Cleopatra had played him false; and she, overcome by remorse and grief, placed the asp to her breast that it might "the knot intrinsicate of life untie," and thus unite her in the grave with him whose absence filled her life with woe; and the same motives which, thirty years before the birth of Christ, made Antony and Egypt's queen "a-weary of the sun," rule just as powerfully to-day in modern hearts.

Such causes, though occurring everywhere, are, of course, more frequent in large cities like Paris, London, and New York, the former probably taking precedence, it being no uncommon sight to see upon the marble slabs of the Morgue three or four dead bodies which have been recovered from the Seine. When the history of such cases can be learned, they show, in the majority of instances, the absence of domestic ties, coupled either with misguided love and jealousy or dissipation and remorse. Indeed, so far as men are concerned, we must consider marriage, with its accompanying influences of home and children, a most important prophylactic. In regard to women, however, this statement does not hold good, for with them suicide is more frequent among the married than the single, the proportion being 10 to about 9 or 9·4. This may be explained to some extent by the mental disturbances produced by pregnancy and childbirth, but the strongest reason undoubtedly is that a girl's youthful dreams of happiness are often shattered by the realities of married life.

One of the most interesting tables in this connection is that compiled by Bertillion, and first published in the "Revue Scientifique" for 1879. He found that among a million of inhabitants, taken from all classes, the following numbers committed suicide, viz.:

Married men with children..	205	Married women with children.....	45
Married men without children.....	470	Married women without children.....	158
Widowers with children.....	526	Widows with children.....	104
Widowers without children.....	1,004	Widows without children.....	238

We here learn the interesting facts that, when marriage is childless, the number of suicides is doubled in men and trebled in women; and also that maternal love diminishes the number of suicides among widows with children by one third over those of childless unions.

This table also shows that males exceed females in the frequency of the act in the proportion of four to one. While this is true of suicides in general, it certainly is not the case in those who are insane. My experience leads me to believe that suicidal tendencies in the insane are quite as frequent among women as among men, and I am sure that the former frequently show the more determination and persistence. In the outside world men lead more exciting lives and are subject to greater mental strain than women, and it is therefore natural that they should more frequently resort to suicide. Another probable reason for the comparative infrequency of suicide among women is that they are better endowed with religious fervor and possess a larger share of hope. In India and Japan only does this rule fail to hold

good, and there the number of suicides among women is twice as great as among men. This fact bears striking witness to the hardships of woman's lot in countries removed from the influences of civilization.

Statistics show that the months in which the fewest suicides occur are October and November, while the greatest number occur in April, May, and June. July and September also have a goodly share, the latter possessing a peculiar fascination for women. This refutes the old idea that suicides occur most frequently in damp and gloomy weather, for the months just mentioned as being the most prolific are certainly those in which the skies look brightest and the earth is fairest. Another remarkable fact in this connection is that the progressive increase and decrease in the number of suicides coincide with the lengthening and the shortening of the days, and, as M. Guerry has shown, not only the seasons of the year, but the days of the month and of the week, and even the hours of the day exert an influence, the constancy of which can not be mistaken. As a result of his elaborate research he found that the greatest number of suicides among men occurred during the first ten days of the month, and from Monday to Thursday of the week. This is accounted for by remembering that the majority of workingmen receive their wages either on the first of the month or the last of the week, and that "pay-day" is often followed by dissipation, debauchery, and remorse. Oettingen completed this interesting observation by showing that the larger number of suicides among women take place during the last half of the week, when they are most apt to feel the effects of man's prodigality and wrong-doing. In regard to the hours of the day, we know, from Brierre de Boismont's examination of 1,993 cases of suicide in Paris, that the maximum number occurred between 6 A. M. and noon, and thereafter regularly declined, reaching the minimum at the hour before sunrise.

It is also an established fact that the more rugged natures of men impel them to seek coarser means of self-destruction, such as the revolver, the razor, and the rope, the latter being most frequently used by those in whom the vigor of manhood is lost. Women, on the contrary, seldom resort to measures which they think will disfigure them, and therefore most frequently seek death by poisoning, asphyxia, or drowning. This, of course, only refers to cases in which the suicide has opportunity to adopt the method preferred. In hospitals for the insane almost all suicides, both male and female, and of whatever age, are accomplished by suspension, that being generally the most available method.

Epidemics of suicide frequently occur, and he who introduces any unusual method is sure of having numerous followers. In 1793 an epidemic occurred in Versailles, and the population was

decreased within a single year by 1,300 self-sought deaths. In the Hôtel des Invalides an inmate hung himself upon a certain cross-bar, and within a fortnight five more did the same thing, although there had not been a single case of suicide in the establishment for two years before, and the threatened epidemic was only averted by the removal of the fatal bar.

Lord Bacon, in his "Essay on Death," says that, "after Otho, the emperor, had slain himself, pity (which is the tenderest of affections) provoked many to die out of mere compassion to their sovereign." Plutarch tells us that the women of the ancient city of Miletus, becoming melancholy over the absence of their husbands and lovers, resolved to hang themselves, and vied with each other in the alacrity with which they did the deed. Various other epidemics have occurred in more recent times—viz., at Rouen, in 1806; at Stuttgart, in 1811, etc.,

What might almost be called an epidemic prevailed in the New York State Lunatic Asylum in July, 1850. According to the report for that year, there were at one time twenty-eight persons in the institution bent upon destroying themselves. There were admitted during that month forty-four patients, nineteen of whom were suicidal. The first successful attempt occurred on the 12th, and on the following day two more, who had been in the asylum for a long time and had never shown suicidal tendencies, attempted strangulation, and were so persistent that they were only prevented from carrying out their designs by mechanical restraint. On the 17th, 20th, and 22d other attempts were made by various patients, and before the end of the month, at which time it subsided, there had been fourteen distinct attempts by eight persons, while several others, in whom the propensity was strong, required constant watching to prevent them from accomplishing their object.

These epidemics are, to a great extent, the result of the principle of imitation, and it may be said that suicide is almost as much the subject of fashion as is dress or household decoration, and that each particular method reigns for a time and then gives way to some newer means. For instance, a man destroys himself by plunging from the heights of a tower. The newspapers graphically record the fact, and straightway a dozen more do the same thing, and the practice is only stopped when some one who is tired of life sends a bullet through his brain. This method is then adopted until another takes a dose of carbolic acid, when that in turn becomes the prevailing means.

Another proof that suicide is often due to the faculty of imitation is the fact that many cases are recorded of children committing the deed, without apparent cause, after having heard of a case in which their interest was aroused.

Among the most remarkable attempts at suicide upon record is that of a man in Fressonville, in Picardy, as related by Dr. Winslow, who was actuated by a desire to ring his own death-knell. To accomplish this object he hanged himself to the clapper of the church-bell. But, fortunately, he chose an hour at which it was not customary for the bell to ring, and attention was attracted in time to save his life. Another very deliberate attempt, probably the most extraordinary ever known, was that made by an Italian shoemaker, named Matthew Lovat. This case was originally reported by Dr. Bergierre, afterward enlarged upon by Dr. Winslow in his "Anatomy of Suicide," and has since been frequently quoted by various writers. The history of the case in brief is that the man determined to imitate as nearly as possible the crucifixion of our Saviour, and therefore deliberately set about making a cross, and providing himself with all the adjuncts of that scene. "He perceived that it would be difficult to nail himself firmly to the cross, and therefore made a net which he fastened over it, securing it at the bottom of the upright beam and at the ends of the two arms. The whole apparatus was tied by two ropes, one from the net and the other from the place where the beams intersected one another. These ropes were fastened to the bar above the window, and were just sufficiently long to allow the cross to lie horizontally upon the floor of the apartment. Having finished these preparations, he next put on his crown of thorns, some of which entered his forehead; then, having stripped himself naked, he girded his loins with a white handkerchief. He then introduced himself into the net, and, seating himself on the cross, drove a nail through the palm of his right hand by striking its head upon the floor until the point appeared on the other side. He now placed his feet upon a bracket he had prepared for them, and with a mallet drove a nail completely through them both, fastening them to the wood. He next tied himself to the cross by a piece of cord around his waist, and wounded himself in the side with a knife which he used in his trade. The wound was inflicted two inches below the hypochondrium, toward the internal angle of the abdominal cavity, but did not injure any of the parts which the cavity contains. Several scratches were observed upon his breast which appear to have been done by the knife in probing for a place which should present no obstruction. The knife, according to Lovat, represented the spear of the passion. All this he accomplished in the interior of his apartment, but it was necessary to show himself in public. To accomplish this he had placed the foot of the cross upon the window-sill, which was very low, and by pressing his fingers against the floor he gradually drew himself forward until, the foot of the cross overbalancing the head, the whole machine

tilted out of the window and hung by the ropes which were fastened to the beam. He then, by way of finishing, nailed his right hand to the arm of the cross, but could not succeed in fixing the left, although the nail by which it was to have been fixed was driven through it, and half of it came out on the other side. This happened at eight o'clock in the morning. Some persons by whom he was perceived ran up-stairs, disengaged him from the cross, and put him to bed. By medical care his wounds ultimately healed, but he was ever afterward morose and singular."

A person bent upon suicide will sometimes await a favorable opportunity for months, or overcome apparently insurmountable difficulties by the exercise of ingenuity which, if it were devoted to the accomplishment of a better object, would be worthy of the highest commendation. Dr. Wynter cites the case of a man who was placed under medical observation because he had attempted to commit suicide. He was watched with the greatest care; during nine months all means—so far as his attendants knew—by which he could injure himself were removed. But one morning he was discovered hanging by his neck from the bedstead, quite dead. How he became possessed of the cord was an enigma which was afterward solved by the discovery that he had carefully preserved every piece of string from the parcels that had been sent to him from time to time. With them he had twisted a rope sufficiently strong to accomplish his purpose. The newspapers a few months ago reported the case of a man named Frederick Helbig, of Zanesville, Ohio, who also showed considerable inventive talent. He was blind and disconsolate, and therefore resolved to die, but as none of the common methods were suited to his purpose he made his way to the cellar, broke off a piece of the gas-pipe, and then covering the end of the pipe and his head with a heavy quilt, quietly suffocated himself with the gas.

Another extraordinary case is that of a man who was quite recently admitted to the Buffalo Insane Asylum. He had attempted suicide the day before while in the station-house, and, owing to his dangerous tendencies, he was placed under the care of a special night-watch, who sat outside his door. For three nights all went well, but on the fourth he jumped from the head of his bed for the transom over his window, the only exposed glass in the room, crashing through the panes and seizing the bars on the outside. Before the attendant could prevent it he had, with a bit of glass, cut into his throat, severing the thyroid cartilage. The patient was in a frenzied condition, and it required the efforts of five attendants to keep him from tearing open the wound. The cartilage was united and the wound sewed and dressed. Foiled in his attempts to tear open the wound, he fixed his lips and jaws tightly and exhaled forcibly. He succeeded literally in blowing

himself up, for the air found its way through the slit in the cartilage into the tissues about the wound, and in a few seconds the emphysema extended as low as the clavicles and so high that his features lost all expression. He refused food and resisted nutritive enemas and shortly died of exhaustion.

The question, "Is suicide an evidence of insanity?" is one which has given rise to much discussion. In olden times it seems always to have been considered a crime, and very severe laws were enacted against it. The Hebrews did not bury the bodies of suicides until after sunset, thus treating them as they did executed criminals. The Armenians cursed and burned the house in which the suicide had lived. At Thebes their bodies were burned and no funeral rites allowed; while the Greeks, on the contrary, among whom it was the custom to burn the bodies of those who died a natural death, buried suicides immediately, as they thought it a wrong to contaminate fire, which they deemed a holy element, by burning in it the bodies of those who had been guilty of self-slaughter. In England it was formerly attended by some of the consequences of felony,* hence the term *felo de se*. All of the personal property which the party had at the time of committing the deed, even including debts to him, was forfeited to the crown, and his remains were interred, without the rites of Christian burial, in the public highway, with a stake driven through the body. In fact, everywhere was the act proscribed and considered a crime, until the present century, when it began to be regarded by many writers as a positive proof of insanity. Esquirol says, "I believe that I have proved that all suicides are mentally diseased"; and Dr. Winslow, one of the greatest authorities on this subject, supports Dr. Rowley's assertion that "suicide should ever be considered an act of insanity." On the other hand, Blandford, Griesinger, Bucknill, Tuke, Gray, and nearly all modern authorities think that suicide is often committed by people in whom no disease of the brain exists. Indeed, Dr. Gray went much further, and in one of his lectures said, "Suicide, though always an unnatural act, is, in the large proportion if not in the majority of cases, committed by persons who are entirely sane." Whether it is or is not the act of insanity can only be determined by a careful inquiry, as there are many cases to support either side of the argument, and each one must be a "law unto itself." For instance to be insane enough to commit suicide does not imply that a man must be a raving lunatic, "cutting strange antics before high Heaven," which make his madness apparent to the most unpracticed observer. Indeed, in many instances the attempt at suicide is the

* The new penal code makes it in this State a felony to attempt to commit suicide. Lawrence Ballard was sentenced to one year's imprisonment under this section, on February 8, 1883. This was the first conviction for the crime in New York under the new code.

first prominent symptom of insanity, and frequently the intensity of the suicidal tendency subsides with the progress of the disease. All who know anything about the insane will admit that lunatics very frequently possess extraordinary cunning in concealing their lunacy, and that the malady, in many cases, is successfully hidden from friends and acquaintances until some remarkable departure from the ordinary ways of life brings it to light. A case in point is that of Hood Alston, who committed suicide in New Orleans in the early part of 1879, after writing a full explanation of why he wished to die. He had been an able writer for the newspapers in many of the large cities, his habits had been those of a gentleman, and his death, in the absence of the letter which he left, would have been inexplicable. He was in the Interior Department at Washington, and was afterward appointed the secretary of a mining company in California. He was married and had every requisite for domestic happiness. "Last November," he wrote, "I became possessed of an impulse to kill my friends. I could hardly resist an opportunity. The desire would be but for a moment and then pass away. An infant was born to us two months ago. I loved it, was proud of it. When it first looked upon me the desire seized me to prey upon its young life. My friends were ignorant of my mental condition. I imparted it to no one, not even to my darling wife. I die that others may live." Dr. Winslow relates a singular case of a man who was heard to exclaim: "Do, for God's sake, get me confined, for if I am at liberty I shall destroy myself and wife; I shall do it unless all means of destruction are removed, and therefore do have me put under restraint. Something above tells me I shall do it, and I shall." Mr. Chevalier also tells us of a young lady of delicate constitution, although she had never given any symptoms of mental derangement, who suddenly started up from the tea-table and rushed to the window, out of which she endeavored to throw herself. It was with great difficulty that she was prevented from accomplishing her design. She remained insane during the rest of her life, which he adds, "was fortunately not long protracted." Such cases illustrating the frequency and intensity of the suicidal and homicidal propensity abound in every work on mental disease and are found in every asylum. But, on the other hand, there are undoubtedly many cases of suicide in which the hypothesis of insanity is untenable. Cato stabbed himself rather than live under the despotic reign of Cæsar; Themistocles poisoned himself rather than lead the Persians against his countrymen; Zeno, when ninety-eight, hung himself because he had put his finger out of joint; and Hannibal and Mithridates poisoned themselves to escape being taken prisoners. When we search Scripture we find that Saul, rather than fall into the hands of the Philistines, commanded his

armor-bearer to hold his sword that he might plunge upon it; Samson, for the sake of being revenged upon his enemies, pulled down the house in which they were reveling and "died with them"; and Judas Iscariot, after selling the Saviour for thirty pieces of silver, was overcome by remorse "and went and hanged himself." The examples quoted from ancient history show that the deed was the result of Stoic philosophy, and those from the Bible show motives sufficient for the act, and in all must we discard the theory of insanity.

To come down to our own times, we may take, for example, the case of Benjamin Hunter, the Camden murderer. For four or five days before his execution he made a practice of sitting over the prison register, with his legs covered by a blanket, and, under the pretense that they were cold, kept rubbing them with his hands, leading those who saw him to believe that he did so only for the purpose of increasing their warmth by restoring the circulation through them. Upon the night preceding the execution he managed to secrete a basin in which he placed his feet, and after cutting through the vessels with a piece of sharpened tin he commenced the process of rubbing, and was actually forcing out his life with every movement when his appearance attracted the attention of the keeper. His object had almost been gained, and, under the circumstances, can we say that it was an insane one? He was a proud man, who dreaded the disgrace of a public execution; he also possessed in a marked degree the desire to cheat the law of its deserts, which is a characteristic tendency of the criminal mind; in one constituted and situated as he was there were sufficient reasons to account for the attempt, and, instead of its being the act of a madman it was merely the effort of a determined will to accomplish a desired end. Cases innumerable might be cited, did space permit, where persons of undoubted sanity have committed suicide for the purpose of escaping suffering, punishment, or disgrace. In fact, a great many of the suicides of which we daily read, probably the majority, can not be considered due to cerebral disease, but must be looked upon rather as the result of social laws, combined with false training and education.

"Is suicide ever justifiable?" is another mooted question, and many writers have answered it in the affirmative. Epictetus, Zeno, Pliny, Seneca, and Plutarch were its advocates. Hume, in his "Essay on Suicide," says: "It would be no crime for me to divert the Nile or Danube from its course if I could; where, then, is the crime of turning a few ounces of blood out of its natural channels?" Rousseau taught, "To seek one's own good and avoid one's own harm in that which hurts not another, is the law of Nature." Budgel believed that, "when life becomes uneasy to support, and is overwhelmed with clouds and sorrows, man has a

natural right to deprive himself of it, as it is better not to live than to live in pain." Montesquieu, Montaigne, Dr. Donne, and others have advanced similar ideas; but it is needless to say that their arguments can find support only in the minds of those who believe that "death endeth all."

The tendency has always been to palliate the act, and the verdict, "committed suicide while laboring under temporary aberration of mind," has become a stereotyped phrase. This verdict was frequently rendered in earlier times for the purpose of preventing the property of the deceased from reverting to the crown, and it has been kept alive in more recent times by the desire, which is inherent in every human breast, to speak kindly of the dead. It is evident, however, that such a verdict should only be rendered when the actions of the deceased have been such as to point very strongly to insanity, or where the autopsy shows undoubted lesions of the brain. Under such conditions no other verdict would be just. But when one becomes "a deserter from the army of humanity," and resorts to suicide as a means of escape from the trials of life, the act is merely a confession of weakness, which, while it may awaken feelings of compassion, certainly does not call for palliation. There are conditions of life, I will admit, to which death might seem far preferable; but though our misfortunes may be such as to make us long for the grave, we must, to slightly change the noble words of Burke, "even in despair live on," remembering that—

> "Our time is fixed, and all our days are numbered;
> How long, how short, we know not; this we know,
> Duty requires we calmly wait the summons,
> Nor dare to stir till Heaven shall give permission."

SEA-BUTTERFLIES.

By Prof. CARL VOGT.

THE little boat lay ready at the dock of Nice; I had at that time to depend upon my own hands. The idea that a permanent station could be established on the sea-coast, with laboratories in which the student could find in one place all the aids he would need in the investigation of sea-animals, had not yet occurred to any one. It was not till I had worked two years in Nice, and had suffered all the inconveniences and loss of time that come from deficiency of means, that I devised plans for building such an establishment, which all came to no result till Herr A. Dohrn, with unexampled energy, founded the zoölogical station in Naples, a model that has been imitated in nearly all coast countries.

Thirty years ago, we did the best we could. I was living in Nice in a private house, since turned into a hotel, which stood on a projecting rock. My fishing-ground was in the Bay of Villafranca, which, cutting deep into the shore a few kilometres to the eastward, was inexhaustibly rich in swimming creatures. I had come to an understanding with an intelligent fisherman. When the weather seemed favorable to the flowing of rich tides into the bay, Joacchino would come early in the morning to my house and tell me that the Graziella lay at the dock. Then he would pack two baskets with large, wide-mouthed glasses; I would stuff into my pockets as many small glasses as they would hold, and take a net made of the finest bolting-cloth stretched upon a copper ring, and furnished with a long, strong handle. Joacchino had a similar net of his own in the boat. Magnifying glasses and compasses, hung by ribbons from the neck, completed the outfit, which was quickly deposited in the boat; Joacchino rowed, for we only went out when the air was still, and I steered. In about an hour we were in the bay.

"Do you see the tide, Joacchino?"

"There, sir, before the Sanita," answered Joacchino, after having risen and looked around.

I saw, indeed, the clear streaks with smooth, unruffled surface that usually denote the coming in of the tide.

"I hardly think," I said, "that we shall fill our vessels to-day. It is getting cloudy, and the sun is not shining."

"So much the better, sir. The sirocco is blowing outside on the sea, and will come in here in the afternoon. Do you see the long swells on the tide which run from the offing along the coast to the back of the bay? I will wager that the stream reaches to the other side of the bay, over by the lighthouse, and from there to the mouth. That is a good sign. The more cloudy the sky is, the more butterflies we shall catch."

"We must go out from the land to catch butterflies. We might perhaps get a few swallow-tails, mourning-cloaks, or a few pretty Jasons out there; but here—"

Joacchino somewhat nervously drove the boat by vigorous oar-strokes to the edge of the stream, which was really swarming with animals of various kinds.

While the *Medusæ* and the polyps had some attractions for him, he aimed particularly for a place where a transparent animal was making a fierce eddy in the stream. I at once recognized the indomitable creatures that turn so wildly in circles. It was a perfectly transparent *Pterotrachea,* about a span in length, as thick as one's finger, which keeps its long snout incessantly foraying around.

"Where you see them," said Joacchino, "the butterflies are not

far off. There! you have a handsome one, of the largest kind." He handed me a glass, with which he had dipped some out of the water.

I am quite proud of young Joacchino. He has eyes like a lynx, and has learned that the more delicate animals must not be touched with a net, but must be let run in with the water into a glass held out to receive them. In deep water the net must be handled so as to cause an eddy by the side of the animal that shall draw it along on the surface.

"Bravo, Joacchino!" I said, after examining the animal in the glass. "I know now what you know about butterflies." The animals which have been named *Pteropoda*, or wing-footed, really deserve the name. They are excitable creatures, that fly round in the broad glass, often strike the walls in their vehement movements, then suddenly draw in their wings, turn downward, and slowly sink to the bottom, to spring up again after a time and begin the old play anew. I recognized at once the boat-butterfly, dedicated to the famous seaman Peron, the *Cymbulia peroni* (Fig. 1). A little way off, one sees merely the eddy in the water

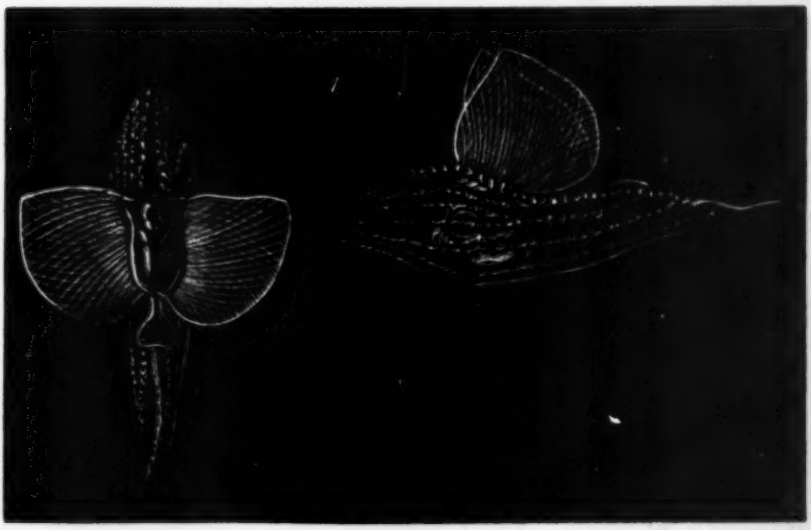

FIG. 1.—CYMBULIA PERONI.

and a brownish kernel about the size of a grain of wheat; only on a closer inspection can we distinguish two large, roundish wings, as clear as glass, that sit upon a yellowish body drawn backward in length, that rests in a crystal boat, the contour of which can not be exactly discerned, because the substance of which it is formed has the same refractive power as water. It is only when the animal is put, hardly covered with water, in a flat saucer of glass, against a black ground, that we can see the figure

of a boat hollowed above, rounded in front, and drawn out into two points behind (Fig. 1) the outer surface having wart-like processes, while fine points like the teeth of a saw rise from the upper edges in front of and behind the body.

The body itself lies in the upper hollow of the boat, and is so loosely fixed to it that if carelessly handled it is easily separated from the shell. The shell is made of a uniform and structureless substance, about midway in consistence between jelly and gristle. The animal does not appear to be especially affected in its motions by separation from the boat, but flies around in the water as before; but, as it does not live long in captivity, it has not been possible to determine whether or not it is able to form a new shell. It may be said, against such a supposition, that besides perfect animals, only empty shells or rarely shelless animals are found in the sea, while none have ever been observed with imperfect shells, as must have been the case did a new growth take place.

The body is very curiously constructed. Leaving out the wings, it appears insignificant in proportion to the shell, and as if buried in it. The fore-part corresponds with the thicker, bluntly rounded part of the boat. In the posterior channel plays a thread-like tail-appendage, starting from a heart-shaped, extremely thin, and transparent fin, which is attached to the body by a thicker stem. There is no head; in front, at the spot where the wings join in the central line, lies the mouth, projecting in the shape of a little round mast, behind which a dark-brown, crescent-shaped streak may be perceived. This is the pharynx-head shining through the body-cover. Like other mollusks, this animal bears a peculiar inner armament which has been wrongly named the tongue, but has not the least in common with the tongue of vertebrates. This tongue is variously formed, according to the food of the animal—like a file or rubber in plant-eaters, or provided with teeth, hooks, and thorns in carnivores. All the sea-butterflies have on their tongues rows of strong, pointed hooks; they are—perhaps with a few exceptions—distinctively carnivorous. But our fishing did not end with the capture of a few *Cymbuliæ* and slipping them into the glasses which we had provided, for inspection at home. The *Cymbuliæ* are the giants among the sea-butterflies of the Bay of Villafranca; a multitude of small fry also swim in the tide which even the most skilled eye can not distinguish from the water, so clear and transparent are they.

"Slowly, Joacchino! Let us drift with the stream!"

I sink the fine net into the water, so that its rim is barely under the surface, and set the long handle on the edge of the boat against the thole-pin. Joacchino slowly pushes the boat onward without beating the water.

"Stop! Give me the lager-beer glass!"

Blessed be Gambrinus! Without his invention, nobody perhaps would have thought of furnishing beer-glasses with fixed handles. The net, which was filled with a mass of swimming creatures that could not escape, was raised above the water till there was room to dip out of it with a beer-glass. We have been fortunate, for we have fallen upon a swarm of needle-butterflies,

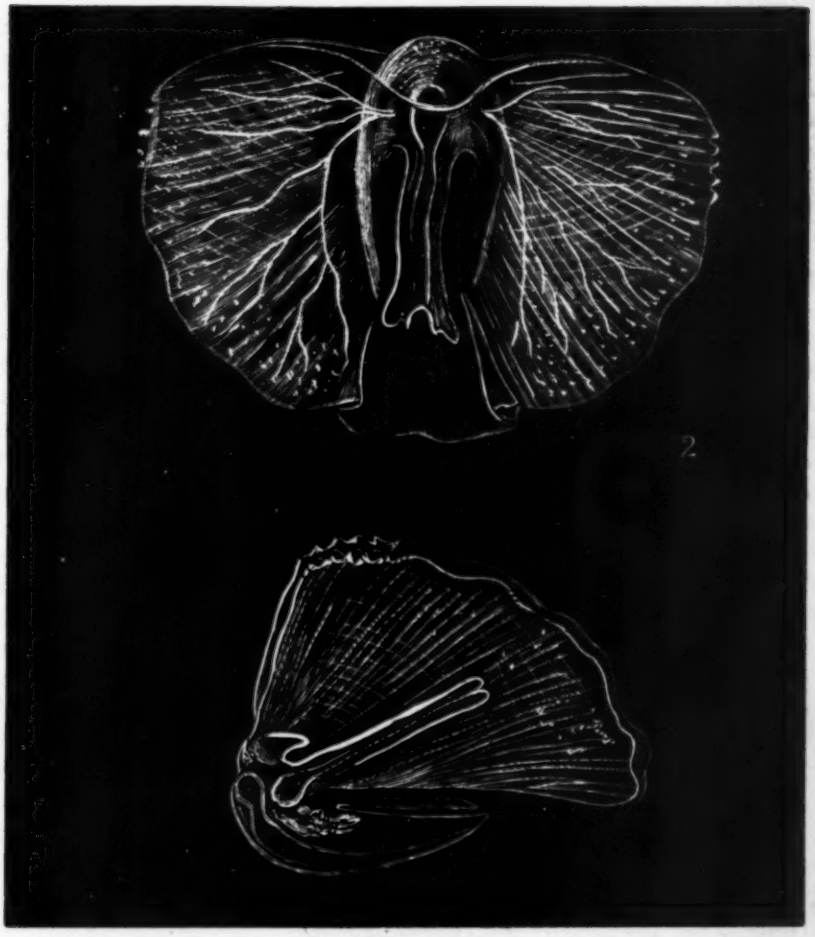

FIG. 2.—TIEDEMANNIA.

Creseis acicula (Fig. 3), and have caught a considerable number of them in our glass, besides other shelled species, such as *Hyalea tridentata* (Fig. 4), and *Cleodora lanceolata* (Fig. 5). But it is best to isolate them, and to separate from among the other little transparent minnows certain crustaceans, some of which might take a notion to attack the butterflies and eat them. Then we turned toward home. The hour and a half occupied in the journey back was spent in selecting out.

I let the water run out of the net into a small glass, so as to be sure that it contains no other animals, and take a glass tube long enough easily to reach the bottom of the mug. The life here is all in a confusion of panic on account of the cramped quarters. I introduce the tube, holding the upper end tightly closed with my forefinger. The air contained within it permits very little water to enter.

We have now to keep a sharp lookout. When I perceive a butterfly which perhaps has sprung at a bound to the surface and is now gently sinking back, I try to bring the lower end of my tube close to it. My forefinger is then suddenly raised; a stream of water, stronger as the tube is deeper in, presses out the escaping air and draws the animal in with it. My forefinger is then brought down to close the upper end, the tube is drawn out, and the animal in it is transferred to the collecting-glass. This is a simple method of catching such small and delicate animals, but must be well practiced if one would acquire any skill in it. It can not be used successfully in a rough sea, and when that is the condition the student must wait till he gets home. But when the animal is secured, it is a real joy to lose one's self in contemplating it with the lens and microscope. The needle-butterflies are a beautiful object. Their cylindrical, glass-clear shell is firm enough to stand a slight pressure. An animal is caught in the prescribed way and put in a compressorium; a small instrument, a thin glass-plate or cover, is used with a tortuous movement to bring it closer up on the stand, which is also of glass. A drop of water is made to fall on the stand, the creature to be examined is brought up, and the two plates are twisted till both touch the drop. We might crush our specimen with the apparatus; but we carefully regulate the pressure so that no harm shall come to it while it is held fast in the same place. It struggles, beating with its wings, but all its exertions are in vain; it can not in the narrow space overcome the pressure that weighs upon its shell.

It is a wonderful view we get under the microscope of the fine muscular fibers crossing one another in the wings, now drawing together and now extending out, and we can follow the ramifications of the nerves and the vessels of the circulation. We perceive the motions of the mouth as it opens and shuts, the pharynx-head with the tongue, which is projected and withdrawn, the connections of the intestine; we see the heart beat, and can follow the current and eddies of water which are produced in the breathing-pores and certain secretory openings by the beating of innumerable cilia in their regular way. The animals are hermaphrodite. We can see the eggs and other products in the organs where they are generated and in the channels through which they are expelled. Only a few hours passed before the needle-butterflies and

their relatives could be seen laying eggs, with transparent shells, which resembled rosaries or long pods, in the spaces of which the eggs swam in a clear liquid. Do they lay these eggs because they are comfortable in the vessel, or in order to rid themselves of what is a burden in their straitened captivity? While this question is still unanswered, it is certain that such strings of eggs and pods are also found drifting in the open sea, that the eggs which are laid in captivity are usually fertilized, and that the development of the embryo can be followed under the microscope —at least, till the point when the larvæ, which go through many metamorphoses, leave the shells to swim in the sea. These do not resemble the parents, but the larvæ of creeping sea-mollusks, and swim by means of a ciliary apparatus which grows on the head, and afterward, when the wings have been formed, is repressed. The free larvæ have not been successfully raised any further in captivity. Probably they die of hunger, for it is impossible to feed them. But we can fish them out of the sea in a net, and can compare from the various forms found among them the succession of single steps in their growth to the adult state. This is, indeed, not always easy, for, on the one hand, the larvæ of different species are often very much alike, and, on the other hand, the currents do not always fetch what is wanted, so that many observers have to wait year after year to continue their observations and bring them to a conclusion.

Dealing with the pelagic animals that swim on the high sea is a delicate matter, and, despite the most careful researches, the

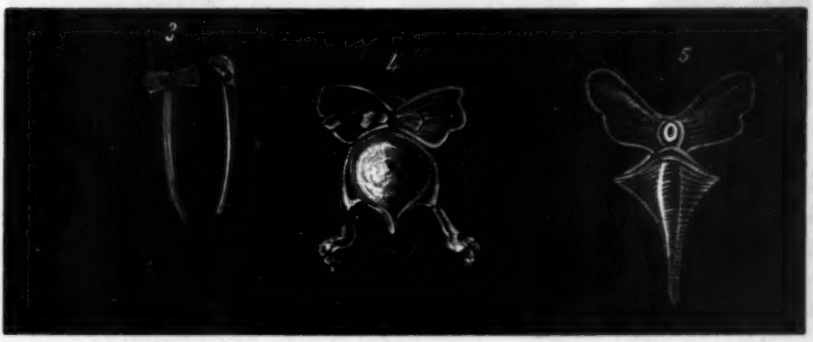

FIG. 3.—CRESEIS ACICULA. FIG. 4.—HYALEA TRIDENTATA. FIG. 5.—CLEODORA LANCEOLATA.

cause of their appearance and disappearance has never been ascertained. In the years from 1850 to 1852, which I spent in Nice, and when I fished with my fine net at least twice a week in the Bay of Villafranca, I only found a few species of needle-butterflies and related species. *Cymbuliæ*, which could not have escaped me then, I first found at a visit in the Easter vacation of 1867, when they were very numerous. Messina is the Mediterranean station

where the butterflies are brought in the largest number and most various forms from the stream of Charybdis. When I last spring asked my colleague there, Prof. Kleinenberg, to send me a few specimens of a naked shelless species (*Pneumodermon*), my courteous friend sent me a goodly number of other butterflies, and wrote: "I am sorry I can not send *Pneumodermon*. While it was formerly so abundant that one could hardly make a haul without having some in his net, there are now none here." The same Job's comfort came from the zoölogical station at Naples, which usually afforded remarkably fine sea-animals, and where I myself had obtained *Pneumodermon* two years before. I received a splendid lot of other butterflies, which were so well preserved that one could almost believe they were still alive; but *Pneumodermon* was not among them.

In Messina, however, is found the round butterfly, *Tiedemannia* (Fig. 2), of gigantic proportions when compared with the others, which somewhat resembles the mourning-cloak of the land-snails,

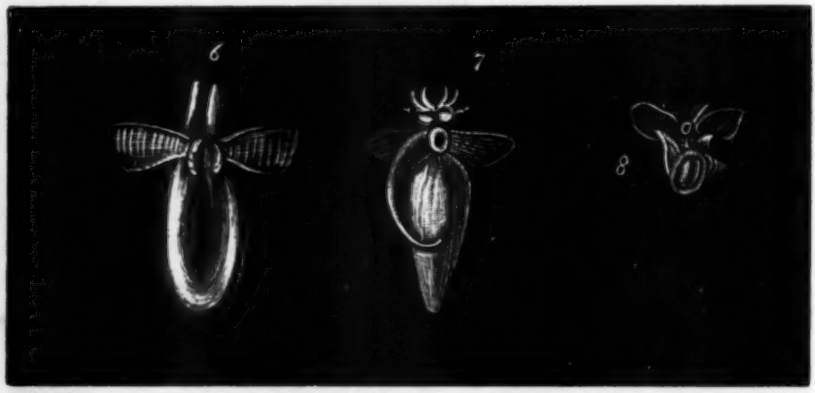

FIG. 6.—CLIMOPSIS KROHNII. FIG. 7.—CLIONE BOREALIS. FIG. 8.—LIMACINA ARCTICA.

but is otherwise of like structure with the *Cymbuliæ*. It also has a water-clear shell, but much smaller and entirely smooth; its wings are united into a large disk, and its mouth is drawn out into a long, double-tipped snout, which the animal carries in swimming like a rakish mast between the wings.

All the sea-butterflies mentioned above are predatory, but I am inclined to believe that certain gorbellies, which are comparable to corpulent night-moths, and might be called thick butterflies (*Hyalæa*), are also, besides, plant-eaters. They tumble around clumsily at Messina and Naples, are occasionally driven to Villafranca, and are distinguished by their swollen, brownish shell, extending into a point behind, and having a narrow opening, out of which rise the short and massive three-lobed wings. They usually bear ragged or ribbon-like appendages of a brown or dark-

green color, which well adapt them to abiding among the sea-weeds. In the intestines of many specimens which I have examined for that purpose I have found among fine grains of sand and mold dubious remains of sea-plants and little shells of swimming mollusk-larvæ.

Many sea-butterflies are naked, having their spindle-like bodies, instead of shells, covered only by a sack-like skin. The laterally fixed wings are sometimes drawn back into pockets, and over them rises a roundish, somewhat depressed head-part, which is occasionally provided with appendages bearing hooks or suckers. To them belongs the above-mentioned violet-colored *Pneumodermon* of the Mediterranean Sea, which, when danger is impending, envelops itself in a white cloud of slime that is secreted in numerous glands, but is soon exhausted.

A species occurs in the northern seas which, together with a little butterfly, *Limacina arctica* (Fig. 8)—a species having a somewhat spiral, transparent shell—comes into remarkable direct relations with man. The little *Limacinas* appear in immense swarms in the polar seas, and the not less numerous naked Cliones, *Clione borealis* (Fig. 7), which are much larger and inflict grievous destruction upon them. In the Mediterranean Sea the Cliones are represented by the related genus, *Clinopsis Krohnii* (Fig. 6). The polar voyager, Captain Halböll, once tried to bring some living Cliones to Prof. Eschricht, in Copenhagen, for examination. Knowing that they were carnivorous, he fed them with reindeer-meat, which they ate greedily at first; but, although he changed the water frequently, he was not able to keep them alive more than eight days, and had to bring them preserved in alcohol. But Eschricht made a very satisfactory research upon them.

The Limacinas eat little crustaceans, the Cliones eat the Limacinas, and both are consumed by the ton by whales. The Greenland whale appears to live almost exclusively on the two species of sea-butterfly, which it has to swallow in immense quantities to fill its capacious maw. It eats also other pelagic small fry and crustaceans as side-dishes.

These are only indirect relations in which the sea-butterflies inhabiting all seas stand to man. But they are important enough. Without whale-food, no whales; without these, no blubber to grease sailors' water-proof boots and overalls; and without boots and southwesters, no sailors and high-sea fishermen; and without whales, no whalebone, no parasols and umbrellas and corsets, which were not worn by the beauties of ancient times, because they were limited to the productions of the Mediterranean Sea, where there are no Greenland whales. But chains of this kind can be found everywhere.

The older French naturalists—D'Orbigny, Péron, Lesueur—

who paid much more attention to the butterflies of the tropical seas than to those of the nearer Mediterranean, pronounced them nocturnal high-sea animals. They had never been seen near the coast, nor before sunset. They were not found at a less distance than about ten marine miles from the coast, and disappeared in the deep at daybreak. That may be correct for the tropical regions, where a dazzling sunlight is poured upon the highly heated surface of the sea; but it must not be forgotten that the sea-butterflies have no eyes, and their keeping away from the coast, where the water is highly warmed to a considerable depth, may indicate that temperature is more a determining factor in this behavior than light. The sea-butterflies behave differently in the Mediterranean. They are not wanting on sunny days, but are more numerous when the sky is clouded and in the night. In midsummer they are, like many other pelagic animals, extremely rare, and keep themselves in the great deeps. Prof. Chun, of Königsberg, who investigated this matter in the summer of 1886, fished larvæ of *Cymbulia* and *Tiedemannia* from as great depths as a thousand metres. Temperature may also be the decisive moment in this case; why should the animals not spend their summer vacation there? The sea-butterflies of the Mediterranean are not at all afraid of the coast. The Bay of Villafranca is hardly two kilometres wide, and they swim in the straits and harbor of Messina. I have caught multitudes of needle-butterflies in the daytime in that stream, close by the shore.

The case is somewhat different in the polar seas. We hunt the whale during the polar summer, when the sun does not set for months, and not in the polar nights, which are also months long, and when the ships would be frozen in the ice. If the Cliones and Limacinas were night animals they would not come to the surface during the whaling season, and would also not be known to sailors and hunters. They might, in fact, seek the deep in winter for the same reasons that they resort to it in summer in the Mediterranean—to escape extremes of temperature. Everything that lives depends on external conditions, and, as these are not everywhere the same, the behavior of the organisms subject to them must adapt itself to the local relations.—*Translated for the Popular Science Monthly from Land und Meer.*

The fact that the enforcement of the legal requirements as to air-space in school-rooms fails of itself to secure a wholesome atmosphere, has been emphasized by Dr. George Reid's inspections of the schools of Stafford, England, where from 2·039 to 3·708 volumes of carbonic acid per 1,000 volumes of air were found to be present. With all the air that may be allowed, arrangements for some kind of circulation are still necessary.

FARM-LIFE IN CHINA.

By ADELE M. FIELDE.

THE number of persons that may subsist upon the products of an acre of land appears to have been practically determined by the Chinese. On ground that has been tilled for thousands of years they, by a skillful use of fertilizers and by attention to the welfare of each plant, raise crops that would honor a virgin soil.

In this Swatow region probably nine tenths of the men are engaged in agriculture. The farmers live in villages, isolated dwellings being uncommon. The villages are walled, contain no wasted space, and are densely peopled. The wide-spreading, flat fields, lying along the river-banks at the foot of the hills, may be made to yield here on the Tropic of Cancer a constant series of crops without interval on account of winter. Their chief productions are rice, sugar-cane, sweet potatoes, pulse, garden vegetables, peanuts, indigo, sesamum, ginger, the grass-cloth plant, tobacco, and wheat. Rice is the staple food of the people, and in the best years the local product just supplies the local demand. Sugar is the principal export. The cane requires less labor than any other crop, and will grow upon unwatered land, which is unsuitable for rice-culture. One crop of cane or two crops of other produce may be grown in the same year upon unwatered land. On the best rice-fields three crops are sometimes raised. The early rice is sowed in April and harvested in July; the late rice is sowed in August and harvested in November, and the field is then sometimes planted with garden vegetables, which are pulled in March. The expense of fertilizing the third crop is so nearly equal to its value that it is never reckoned as a source of profit to the cultivator.

The whole country belongs theoretically to its sovereign, and upon all land that can be tilled with profit a tax is paid into the imperial treasury. The sum due annually to the Government for the use of land is fixed for each field, amounts to from sixty cents to two dollars, and averages a dollar and a half upon each English acre.

When a father dies his land is divided equally among his sons, the eldest receiving an additional tenth on account of the extra expense to which he is put in worshiping the *manes* of the ancestor. The land is distributed very generally, though unequally, among the people, and is usually tilled by its peasant proprietor. Few own so much as two hundred acres; one who owns ten acres is reckoned wealthy, and he who owns one acre possesses a competence. Those who own from one tenth to one half an acre are

most numerous, and therefore there are many who till land for a share of the produce.

Land that is too sterile for profitable cultivation or for taxation sells for from six to sixty dollars an acre, while good farm-land is valued at from three hundred to eight hundred dollars an acre. Rice-fields not in the vicinage of a city sell readily for six hundred dollars an acre, and are not always to be bought at that price, because those who own land find it the safest investment, and part with it only when under the stress of debt. The bursting of dikes, drought, and bad habits are the chief causes of the transfer of land, and the sale of a child often precedes that of the rice-field. Interest on money lent is from twelve to twenty per cent, according to agreement between lender and borrower.

The chief expense of tillage is in fertilizers, beans and sesamum-seeds from which the oil has been expressed being commonly used, at an outlay of from six to forty and an average of twenty-four dollars upon every acre of land. Besides this, potato-peelings, hair from shaven heads, and all other vegetable and animal refuse is carefully husbanded and methodically applied to the soil. The clods of the field are laid up into little ovens to retain and be enriched by the smoke of the stubble burned underneath them. Adobe houses, whose walls have for many years absorbed the fumes of a kitchen and the exhalations of human inmates, are pulverized and added to the ever-hungry earth. Each growing plant separately receives distinguished consideration, a scrap of tobacco-stalk being sometimes put beside its root to destroy underground grubs, while its leaves are frequently examined and sedulously freed from vermin. The rotation of crops is always practiced.

As no milk, butter, or cheese is used, the only quadruped seen on the farms is the water-buffalo, or the zebu, which assists in plowing and harrowing. Many farmers rear ducks, which are taken to the fields to devour the snails, crabs, and young frogs which thrive there at planting-time. Fowls often accompany the harvesters, picking up the last grains left among the stubble.

Few families are without the ubiquitous black hog, whose usual habitat is the door-step. Its food is the bran of the rice hulled and eaten in the house; its head is the chief offering set before the *lares* and *penates*, and its flesh is most highly esteemed among festive viands. It is reared at small expense, makes no disputed demand on space, furnishes the unctuous element in a satisfying bill of fare, and can always be sold at ten cents a pound.

The farming appliances are simple, and a complete outfit can be bought for forty dollars. A plow with two shares, a pair of harrows, and a fanning-mill each cost two dollars; a pump worked

by treadles in irrigating the fields, four dollars; a water-buffalo, twenty dollars; hoes, sickles, baskets, and sundries, nine dollars.

When land is leased, the owner pays the taxes, and the lessee furnishes all that is required in tillage. Payment to the landlord is always made in unhusked rice, and when the land is worked on shares this amounts to about one half the crop. The usual bargain for the use of land is a ton and a quarter of unhusked rice, worth about thirty dollars, for each acre. If the year be remarkably bad, the lessee may insist upon the landlord's taking one half the crop, though that be manifestly much less than the amount agreed upon as payment. If the year be good and the land excellent, the lessee may pay one third of his crop to the landlord, may have expended another third upon fertilizers, and may have the other third as net profit for his labor. As one man is unable to till more than one acre alone, the average yearly earnings of men who work land on shares is less than thirty dollars. One acre of good land produces on the average 3,648 pounds of clean rice.

A farmer may be hired by the year for from eight to fourteen dollars, with food, clothing, head-shaving, and tobacco. Those who work by the day receive from eight to ten cents, with a noonday meal. At the planting and harvesting of rice, wages are from ten to twenty cents a day, with five meals; or thirty cents a day without food. Few land-owners hire hands, except for a few days during the planting and harvesting of rice. Those who have more land than they and their sons can till, lease it to their neighbors.

Much land is held on leases given by ancient proprietors to clansmen whose descendants now till it, paying from seven to fourteen dollars' worth of rice annually for its use.

Food averages little more than a dollar a month for each member of a farmer's family. One who buys, cooks, and eats his meals alone, spends from one and a half to two dollars a month upon the raw material and fuel. Two pounds of rice, costing three and a half cents, with relishes of salt fish, pickled cabbage, cheap vegetables and fruits, costing a cent and a half, is the ordinary allowance to each laborer for each day. Abernethy's advice to a luxurious patient, "Live on sixpence a day and earn it," is followed by nearly every Chinaman. One or two dependent relatives frequently share with him the sixpence.

Five dollars, wisely spent, each year, will keep up a comfortable and even elegant outfit of clothing for a man or a woman. The clothing is usually woven in hand-looms in the farmer's house, from the fiber of the grass-cloth plant (*Boehmeria nivea*), or from imported cotton yarn. The average amount of clothing possessed by a farmer may be reckoned at four dollars in value.

A room may be comfortably furnished by an outlay of five

dollars, and such a room would usually be occupied by three or four persons. The house varies in value, from the twenty-dollar cabin of the poor to the thousand-dollar dwelling of the rich. The value of the land in the villages in which the agriculturists live is from six to eight hundred dollars an acre.

As the emigration of men is constant, and the smothering of female infants is common, it is probable that the land will support no more than its present population. One sixth of an acre to each mouth to be filled is commonly declared to be the least that will enable the cultivator to live upon his own land, even with the highest tillage and the utmost frugality. One acre, tilled by the peasant proprietor alone, will feed six persons—the peasant, his wife, his aged father and mother, and his two young children. It will yield rice, hulled in the house, and vegetables, raised between rice-crops, sufficient for food. The straw and stubble will serve as fuel, and the pig and fowls will supply meat. The clothing will be woven and made by the wife, while the old couple take care of the children. The aged and the young are thus provided for through the land which has been the property of the one and will be the inheritance of the other. If dirt, superstition, and mendacity were eliminated from such a home, its inmates would appear eminently fit to survive. A process of natural selection has doubtless adapted the Chinese to their environment.

Two brothers, aged thirty-one and thirty-two years, inherited from their father one acre of land, half of which is watered. Their house, with the ground on which it is built, is worth fifty, their furniture fifteen, their clothing twenty, and their farming appliances thirty dollars. They live as well as do their neighbors, have paid up a debt inherited with their land, and are now laying up money to invest in wives. Twenty years ago a wife could be betrothed for thirty dollars, whereas none can now be obtained for less than a hundred dollars, and the price is rapidly rising. Last year they got twenty-seven dollars' worth of rice from one half their farm, after having put on twelve dollars' worth of fertilizers. On the other half they planted sugar-cane, put on fifteen dollars' worth of manure, and sold the standing crop for forty dollars. The younger brother did nearly all the work.

Pong Hia lives in a village of three hundred persons, in which about thirty men are land-owners, having altogether forty-five acres of land. Pong Hia owns two acres, inherited from the father who adopted him. His land is worth one thousand dollars. His family consists of ten persons. He is himself forty-six years old, his wife is forty-one, his son is twenty-two, his son's wife is twenty-one, his four daughters are from ten to seventeen, and his two grandchildren are three and seven years old. He and his son till the land, hiring help at harvest-time, and weaving straw mats on

rainy days. The women-folk make the clothing, rear pigs and fowls, and do all the house-work. Their dwelling, with its site, is valued at a hundred and twenty dollars, their furniture at forty-four dollars, their clothing at forty dollars, their farming appliances at forty dollars. They have a water-buffalo, two hogs, thirty fowls, ten ducks, a pair of geese, a dog, and a cat. Last year Pong Hia sold twenty dollars' worth of rice from his farm, and paid $3.60 in taxes. He has two hundred dollars out at interest, at eighteen per cent.

At this rate of production and consumption, the arable land in the State of New York, with a reduction of one half its returns on account of its more northern latitude, would support the total population of the United States at the present time; and the occupied arable land of the United States, with its producing power diminished, on account of climate, to one half that of land at Swatow, would feed a population equal to that of the whole world, or over 1,400,000,000.

CHRISTIANITY AND AGNOSTICISM.

By Rev. Dr. HENRY WACE,
PRINCIPAL OF KING'S COLLEGE.

READERS who may be willing to look at this further reply on my part to Prof. Huxley need not be apprehensive of being entangled in any such obscure points of church history as those with which the professor has found it necessary to perplex them in support of his contentions; still less of being troubled with any personal explanations. The tone which Prof. Huxley has thought fit to adopt, not only toward myself, but toward English theologians in general, excuses me from taking further notice of any personal considerations in the matter. I endeavored to treat him with the respect due to his great scientific position, and he replies by sneering at "theologians who are mere counsel for creeds," saying that the serious question at issue "is whether theological men of science, or theological special pleaders, are to have the confidence of the general public," observing that Holland and Germany are "the only two countries in which, at the present time, professors of theology are to be found whose tenure of their posts does not depend upon the result to which their inquiries lead them," and thus insinuating that English theologians are debarred by selfish interests from candid inquiry. I shall presently have something to say on the grave misrepresentation of German theology which these insinuations involve; but for myself and for English theologians I shall not condescend to reply to them. I content myself with calling the reader's atten-

tion to the fact that, in this controversy, it is Prof. Huxley who finds it requisite for his argument to insinuate that his opponents are biased by sordid motives; and I shall for the future leave him and his sneers out of account, and simply consider his arguments for as much, or as little, as they may be worth. For a similar reason I shall confine myself as far as possible to the issue which I raised at the Church Congress, and for which I then made myself responsible. I do not care, nor would it be of any avail, to follow over the wide and sacred field of Christian evidences an antagonist who resorts to the imputation of mean motives, and who, as I shall show, will not face the witnesses to whom he himself appeals. The manner in which Prof. Huxley has met the particular issue he challenged will be a sufficient illustration to impartial minds of the value which is to be attached to any further assaults which he may make upon the Christian position.

Let me then briefly remind the reader of the simple question which is at issue between us. What I alleged was that "an agnosticism which knows nothing of the relation of man to God must not only refuse belief to our Lord's most undoubted teaching, but must deny the reality of the spiritual convictions in which he lived and died." As evidence of that teaching and of those convictions I appealed to three testimonies—the Sermon on the Mount, the Lord's Prayer, and the story of the Passion—and I urged that whatever critical opinion might be held respecting the origin and structure of the four Gospels, there could not be any reasonable doubt that those testimonies "afford a true account of our Lord's essential belief and cardinal teaching." In his original reply, instead of meeting this appeal to three specific testimonies, Prof. Huxley shifted the argument to the question of the general credibility of the Gospels, and appealed to "the main results of biblical criticism, as they are set forth in the works of Strauss, Baur, Reuss, and Volkmar." He referred to these supposed "results" in support of his assertion that we know "absolutely nothing" of the authorship or genuineness of the four Gospels, and he challenged my reference to Renan as a witness to the fact that criticism has established no such results. In answer, I quoted passage after passage from Renan and from Reuss showing that the results at which they had arrived were directly contradictory of Prof. Huxley's assertions. How does he meet this evidence? He simply says, in a foot-note, "For the present I must content myself with warning my readers against any reliance upon Dr. Wace's statements as to the results arrived at by modern criticism. They are as gravely as surprisingly erroneous." I might ask by what right Prof. Huxley thus presumes to pronounce, as it were *ex cathedra*, without adducing any evidence, that the statements of another writer are "surprisingly erroneous"? But I in

my turn content myself with pointing out that, if my quotations from Renan and Reuss had been incorrect, he could not only have said so, but could have produced the correct quotations. But he does not deny, as of course he can not, that Reuss, for example, really states, as the mature result of his investigations, what I quoted from him respecting St. Luke's Gospel, namely, that it was written by St. Luke and has reached us in its primitive form, and, further, that St. Luke used a book written by St. Mark, the disciple of St. Peter, and that this book in all probability comprised in its primitive form what we read in the present day from Mark i, 21, to xiii, 37. These are the results of modern criticism as stated by a biblical critic in whom Prof. Huxley expressed special confidence. It was not therefore my statements of the results of biblical criticism with which Prof. Huxley was confronted, but Reuss's statements; and, unless he can show that my quotation was a false one, he ought to have had the candor to acknowledge that Reuss, at least, is on these vital points dead against him. Instead of any such frank admission, he endeavors to explain away the force of his reference to Reuss. It may, he says, be well for him

> to observe that approbation of the manner in which a great biblical scholar—for instance, Reuss—does his work does not commit me to the adoption of all, or indeed of any, of his views; and, further, that the disagreements of a series of investigators do not in any way interfere with the fact that each of them has made important contributions to the body of truth ultimately established.

But I beg to observe that Prof. Huxley did not appeal to Reuss's methods, but to Reuss's results. He said that no retractation by M. Renan would sensibly affect "the *main results of biblical criticism as they are set forth in the works of* Strauss, Baur, Reuss, and Volkmar." I have given him the results as set forth by Reuss in Reuss's own words, and all he has to offer in reply is an *ipse dixit* in a foot-note and an evasion in the text of his article.

But, as I said, this general discussion respecting the authenticity and credibility of the Gospels was an evasion of my argument, which rested upon the specific testimony of the Sermon on the Mount, the Lord's Prayer, and the narrative of the Passion; and, accordingly, in his present rejoinder Prof. Huxley, with much protestation that he made no evasion, addressed himself to these three points. And what is his answer? I feel obliged to characterize it as another evasion, and in one particular an evasion of a flagrant kind. The main point of his argument is that from various circumstances, which I will presently notice more particularly, there is much reason to doubt whether the Sermon on the Mount was ever actually delivered in the form in which it

is recorded in St. Matthew. He notices, for instance, the combined similarity and difference between St. Matthew's Sermon on the Mount and St. Luke's so-called "Sermon on the Plain," and then he adds:

> I thought that all fairly attentive and intelligent students of the Gospels, to say nothing of theologians of reputation, knew these things. But how can any one who does know them have the conscience to ask whether there is "any reasonable doubt" that the Sermon on the Mount was preached by Jesus of Nazareth?

It is a pity that Prof. Huxley seems as incapable of accuracy in his quotations of an opponent's words as in his references to the authorities to whom he appeals. I did not ask "whether there is any reasonable doubt that the Sermon on the Mount was preached by Jesus of Nazareth," and I expressly observed, in the article to which Prof. Huxley is replying, that "Prof. Reuss thinks, as many good critics have thought, that the Sermon on the Mount combines various distinct utterances of our Lord." What I did ask, in words which Prof. Huxley quotes, and therefore had before his eyes, was "whether there is any reasonable doubt that the Lord's Prayer and the Sermon on the Mount afford a true account of our Lord's essential belief and cardinal teaching." That is an absolutely distinct question from the one which Prof. Huxley dissects, and a confusion of the two is peculiarly inexcusable in a person who holds that purely human view of the Gospel narratives which he represents. If a long report of a speech appears in the "Times" and a shortened report appears in the "Standard," every one knows that we are none the less made acquainted—perhaps made still better acquainted—with the essential purport and cardinal meaning of the speaker. On the supposition, similarly, that St. Matthew and St. Luke are simply giving two distinct accounts of the same address, with such omissions and variations of order as suited the purposes of their respective narratives, we are in at least as good a position for knowing what was the main burden of the address as if we had only one account, and perhaps in a better position, as we see what were the points which both reporters deemed essential. As Prof. Huxley himself observes, we have reports of speeches in ancient historians which are certainly not in the very words of the speakers; yet no one doubts that we know the main purport of the speeches of Pericles which Thucydides records.

This attempt, therefore, to answer my appeal to the substance of the teaching of the Sermon on the Mount is a palpable evasion, and it is aggravated by the manner in which Prof. Huxley quotes a high German authority in support of his contention. I am much obliged to him for appealing to Holtzmann; for, though Holtzmann's own conclusions respecting the books of the New

Testament seem to me often extravagantly skeptical and far-fetched, and though I can not, therefore, quite agree with Prof. Huxley that his "Lehrbuch" gives "a remarkably full and fair account of the present results of criticism," yet I agree that it gives on the whole a full and fair account of the course of criticism and of the opinions of its chief representatives. Instead, therefore, of imitating Prof. Huxley, and pronouncing an *ipse dixit* as to the state of criticism or the opinions of critics, I am very glad to be able to refer to a book of which the authority is recognized by him, and which will save both my readers and myself from embarking on the wide and waste ocean of the German criticism of the last fifty years. "Holtzmann, then," says Prof. Huxley in a note on page 489, "has no doubt that the Sermon on the Mount is a compilation, or, as he calls it in his recently published 'Lehrbuch' (p. 372), 'an artificial mosaic work.'" Now, let the reader attend to what Holtzmann really says in the passage referred to. His words are: "In the so-called Sermon on the Mount (Matt. v–vii) we find constructed, on the basis of a real discourse of fundamental significance, a skillfully articulated mosaic work."* The phrase was not so long a one that Prof. Huxley need have omitted the important words by which those he quotes are qualified. Holtzmann recognizes, as will be seen, that a real discourse of fundamental significance underlies the Sermon on the Mount. That is enough for my purpose; for no reasonable person will suppose that the fundamental significance of the real discourse has been entirely obliterated, especially as the main purport of the sermon in St. Luke is of the same character. But Prof. Huxley must know perfectly well, as every one else does, that he would be maintaining a paradox, in which every critic of repute, to say nothing of every man of common sense, would be against him, if he were to maintain that the Sermon on the Mount does not give a substantially correct idea of our Lord's teaching. But to admit this is to admit my point, so he rides off on a side issue as to the question of the precise form in which the sermon was delivered.

I must, however, take some notice of Prof. Huxley's argument on this irrelevant issue, as it affords a striking illustration of that superior method of ratiocination in these matters on which he prides himself. I need not trouble the reader much on the questions he raises as to the relations of the first three Gospels. Any one who cares to see a full and thorough discussion of that difficult question, conducted with a complete knowledge of foreign criticism on the subject, and at the same time marked by the greatest lucidity and interest, may be referred to the admirable

* "In der sog. Bergpredigt, Mt. 5–7, gibt sich eine, auf Grund einer wirklichen Rede von fundamentaler Bedeutung sich erhebende, kunstreich gegliederte Mosaikarbeit."

"Introduction to the New Testament," by Dr. Salmon, who, like Prof. Huxley, is a Fellow of the Royal Society, and who became eminent as one of the first mathematicians of Europe before he became similarly eminent as a theologian. I am content here to let Prof. Huxley's assumptions pass, as I am only concerned to illustrate the fallacious character of the reasoning he founds upon them. He tells us, then, that—

> there is now no doubt that the three synoptic Gospels, so far from being the work of three independent writers, are closely interdependent, and that in one of two ways. Either all three contain, as their foundation, versions, to a large extent verbally identical, of one and the same tradition; or two of them are thus closely dependent on the third; and the opinion of the majority of the best critics has, of late years, more and more converged toward the conviction that our canonical second Gospel (the so-called "Mark's" Gospel) is that which most closely represents the primitive groundwork of the three. That I take to be one of the most valid results of New Testament criticism, of immeasurably greater importance than the discussion about dates and authorship. But if, as I believe to be the case beyond any rational doubt or dispute, the second Gospel is the nearest extant representative of the oldest tradition, whether written or oral, how comes it that it contains neither the "Sermon on the Mount" nor the "Lord's Prayer," those typical embodiments, according to Dr. Wace, of the "essential belief and cardinal teaching" of Jesus?

I have quoted every word of this passage because I am anxious for the reader to estimate the value of Prof. Huxley's own statement of his case. It is, as he says, the opinion of many critics of authority that a certain fixed tradition, written or oral, was used by the writers of the first three Gospels. In the first place, why this should prevent those three Gospels from being the work of "three independent writers" I am at a loss to conceive. If Mr. Froude, the late Prof. Brewer, and the late Mr. Green each use the Rolls Calendars of the reign of Henry VIII, I do not see that this abolishes their individuality. Any historian who describes the Peloponnesian War uses the memoirs of that war written by Thucydides; but Bishop Thirlwall and Mr. Grote were, I presume, independent writers. But to pass to a more important point, that which is assumed is that the alleged tradition, written or oral, was the groundwork of our first three Gospels, and it is, therefore, older than they are. Let it be granted, for the sake of argument. But how does this prove that the tradition in question is "the oldest," so that anything which was not in it is thereby discredited? It was, let us allow, an old tradition used by the writers of the first three Gospels. But how does this fact raise the slightest presumption against the probability that there were other traditions equally old which they might use with equal justification so far as their scope required? Prof. Huxley alleges, and I do not care to dispute the allegation, that the first three Gospels

embody a certain record older than themselves. But by what right does he ask me to accept this as evidence, or as affording even the slightest presumption, that there was no other? Between his allegation in one sentence that the second Gospel "most closely represents the primitive groundwork of the three," and his allegation, in the next sentence but one, that "the second Gospel is the nearest extant representative of the oldest tradition," there is an absolute and palpable *non sequitur*. It is a mere juggle of phrases, and upon this juggle the whole of his subsequent argument on this point depends. St. Mark's Gospel may very well represent the oldest tradition *relative to the common matter of the three*, without, therefore, necessarily representing "the oldest tradition" in such a sense as to be a touchstone for all other reports of our Lord's life. Prof. Huxley must know very well that from the time of Schleiermacher many critics have believed in the existence of another document containing a collection of our Lord's discourses. Holtzmann concludes ("Lehrbuch," page 376) that "under all the circumstances the hypothesis of two sources offers the most probable solution of the synoptical problem"; and it is surely incredible that no old traditions of our Lord's teaching should have existed beyond those which are common to the three Gospels. St. Luke, in fact, in that preface which Prof. Huxley has no hesitation in using for his own purposes, says that "many had taken in hand to set forth in order a declaration of those things which are most surely believed among us"; but Prof. Huxley asks us to assume that none of these records were old, and none trustworthy, but that particular one which furnishes a sort of skeleton to the first three Gospels. There is no evidence whatever, beyond Prof. Huxley's private judgment, for such an assumption. Nay, he himself tells us that, according to Holtzmann, it is at present a "burning question" among critics "whether the relatively primitive narration and the root of the other synoptic texts is contained in Matthew or in Mark."* Yet while his own authority tells him that this is a burning question, he treats it as settled in favor of St. Mark, "beyond any rational doubt or dispute," and employs this assumption as sufficiently solid ground on which to rest his doubts of the genuineness of the Sermon on the Mount and the Lord's Prayer!

But let us pass to another point in Prof. Huxley's mode of argument. Let us grant, again for the sake of argument, his *non sequitur* that the second Gospel is the nearest extant representative of the oldest tradition. "How comes it," he asks, "that it contains neither the Sermon on the Mount nor the Lord's Prayer?" Well, that is a very interesting inquiry, which has, in point of fact, often been considered by Christian divines; and various

* "Popular Science Monthly" for June, 1889, p. 169.

answers are conceivable, equally reasonable and sufficient. If it was St. Mark's object to record our Lord's acts rather than his teaching, what right has Prof. Huxley, from his purely human point of view, to find fault with him? If, from a Christian point of view, St. Mark was inspired by a divine guidance to present the most vivid, brief, and effective sketch possible of our Lord's action as a Saviour, and for that purpose to leave to another writer the description of our Lord as a teacher, the phenomenon is not less satisfactorily explained. St. Mark, according to that tradition of the Church which Prof. Huxley believes to be quite worthless, but which his authority Holtzmann does not, was in great measure the mouth-piece of St. Peter. Now, St. Peter is recorded in the Acts of the Apostles, in his address to Cornelius, as summing up our Lord's life in these words: "How God anointed Jesus of Nazareth with the Holy Ghost and with power, who went about doing good, and healing all who were oppressed of the devil; for God was with him"; and this is very much the point of view represented in St. Mark's Gospel. When, in fact, Prof. Huxley asks, in answer to Holtzmann, who is again unfavorable to his views, "What conceivable motive could Mark have for omitting it?"* the answers that arise are innumerable. Perhaps, as has been suggested, St. Mark was more concerned with acts than words; perhaps he wanted to be brief; perhaps he was writing for persons who wanted one kind of record and not another; and, above all, perhaps it was not so much a question of "omission" as of selection. It is really astonishing that this latter consideration never seems to cross the mind of Prof. Huxley and writers like him. The Gospels are among the briefest biographies in the world. I have sometimes thought that there is evidence of something superhuman about them in the mere fact that, while human biographers labor through volumes in order to give us some idea of their subject, every one of the Gospels, occupying no more than a chapter or two in length of an ordinary biography, nevertheless gives us an image of our Lord sufficiently vivid to have made him the living companion of all subsequent generations. But if "the gospel of Jesus Christ" was to be told within the compass of the sixteen chapters of St. Mark, some selection had to be made out of the mass of our Lord's words and deeds as recorded by the tradition of those "who from the beginning were eye-witnesses and ministers of the word." The very greatness and effectiveness of these four Gospels consist in this wonderful power of selection, like that by which a great artist depicts a character and a figure in half a dozen touches; and Prof. Huxley may, perhaps, to put the matter on its lowest level, find out a conceivable motive for St. Mark's omissions when he can produce such an effective narrative

* "Popular Science Monthly" for June, 1889, p. 171.

as St. Mark's. As St. John says at the end of his Gospel, "There are also many other things which Jesus did, the which, if they should be written every one, I suppose that even the world itself could not contain the books that should be written." So St. John, like St. Mark, had to make his selection, and selection involves omission.

But, after all, I venture to ask whether anything can be more preposterous than this supposition that because a certain tradition is the oldest authority, therefore every other authority is discredited? Boswell writes a life of Johnson; therefore every record of Johnson's acts or words which is not in Boswell is to be suspected. Carlyle writes a life of Sterling first, and Archdeacon Hare writes one afterward; therefore nothing in the archdeacon's life is to be trusted which was not also in Carlyle's. What seems to me so astonishing about Prof. Huxley's articles is not the wildness of their conclusions, but the rottenness of their ratiocination. To take another instance:

> Luke either knew the collection of loosely connected and aphoristic utterances which appear under the name of the "Sermon on the Mount" in "Matthew," or he did not. If he did not, he must have been ignorant of the existence of such a document as our canonical "Matthew," a fact which does not make for the genuineness or the authority of that book. If he did, he has shown that he does not care for its authority on a matter of fact of no small importance; and that does not permit us to conceive that he believed the first Gospel to be the work of an authority to whom he ought to defer, let alone that of an apostolic eye-witness.

I pass by the description of the Sermon on the Mount as a "collection of loosely connected utterances," though it is a kind of begging of a very important question. But supposing St. Luke to have been ignorant of the existence of St. Matthew's Gospel, how does this reflect on the genuineness of that book unless we know, as no one does, that St. Matthew's Gospel was written before St. Luke's, and sufficiently long before it to have become known to him? Or, if he did know it, where is the disrespect to its authority in his having given for his own purposes an abridgment of that which St. Matthew gave more fully? Prof. Huxley might almost seem dominated by the mechanical theory of inspiration which he denounces in his antagonists. He writes as if there were something absolutely sacred, neither to be altered nor added to, in the mere words of some old authority of which he conceives himself to be in possession. Dr. Abbott, with admirable labor, has had printed for him, in clear type, the words or bits of words which are common to the first three Gospels, and he seems immediately to adopt the anathema of the book of Revelation, and to proclaim to every man, evangelists and apostles included, "if any man shall add unto these things, . . . and if any man shall take away from the words" of this "common tradition" of Dr.

Abbott, he shall be forthwith scientifically excommunicated. I venture to submit, as a mere matter of common sense, that if three persons used one document, it is the height of rashness to conclude that it contained nothing but what they all three quote; that it is not only possible but probable that, while certain parts were used by all, each may have used some parts as suitable to his own purpose which the others did not find suitable to theirs; and, lastly, that the fact of there having been one such document in existence is so far from being evidence that there were no others, that it even creates some presumption that there were. In short, I must beg leave to represent, not so much that Prof. Huxley's conclusions are wrong, but that there is absolutely no validity in the reasoning by which he endeavors to support them. It is not, in fact, reasoning at all, but mere presumption and guess-work, inconsistent, moreover, with all experience and common sense.

Of course, if Prof. Huxley's quibbles against the Sermon on the Mount go to pieces, so do his cavils at the authenticity of the Lord's Prayer; and, indeed, on these two points I venture to think that the case for which I was contending is carried by the mere fact that it seems necessary to Prof. Huxley's position to dispute them. If he can not maintain his ground without pushing his agnosticism to such a length as to deny the substantial genuineness of the Sermon on the Mount and the Lord's Prayer, I think he will be found to have allowed enough to satisfy reasonable men that his case must be a bad one. I shall not, therefore, waste more time on these points, as I must say something on his strange treatment of the third point in the evangelical records to which I referred, the story of the Passion. It is really difficult to take seriously what he says on this subject. He says:

> I am not quite sure what Dr. Wace means by this—I am not aware that any one (with the exception of certain ancient heretics) has propounded doubts as to the reality of the crucifixion; and certainly I have no inclination to argue about the precise accuracy of every detail of that pathetic story of suffering and wrong. But if Dr. Wace means, as I suppose he does, that that which, according to the orthodox view, happened after the crucifixion, and which is, in a dogmatic sense, the most important part of the story, is founded on solid historical proofs, I must beg leave to express a diametrically opposite conviction.

Prof. Huxley is not quite sure what I mean by the story of the Passion, but supposes I mean the story of the resurrection! It is barely credible that he can have supposed anything of the kind; but by this gratuitous supposition he has again evaded the issue I proposed to him, and has shifted the argument to another topic which, however important in itself, is entirely irrelevant to the particular point in question. If he really supposed that when I said the Passion I meant the resurrection, it is only another proof of his incapacity for strict argument, at least on these subjects.

I not only used the expression "the story of the Passion," but I explicitly stated in my reply to him for what purpose I appealed to it. I said that "that story involves the most solemn attestation, again and again, of truths of which an agnostic coolly says he knows nothing"; and I mentioned particularly our Lord's final utterance, "Father, into thy hands I commend my spirit," as conveying our Lord's attestation in his death agony to his relation to God as his Father. That exclamation is recorded by St. Luke; but let me remind the reader of what is recorded by St. Mark, upon whom Prof. Huxley mainly relies. There we have the account of the agony in Gethsemane and of our Lord's prayer to his Father; we have the solemn challenge of the high priest, "Art thou the Christ, the son of the Blessed?" and our Lord's reply, "I am; and ye shall see the Son of man sitting on the right hand of power, and coming in the clouds of heaven," with his immediate condemnation, on the ground that in this statement he had spoken blasphemy. On the cross, moreover, St. Mark records his affecting appeal to his Father, "My God, my God, why hast thou forsaken me?" All this solemn evidence Prof. Huxley puts aside with the mere passing observation that he has "no inclination to argue about the precise accuracy of every detail of that pathetic story of suffering and wrong." But these prayers and declarations of our Lord are not mere details; they are of the very essence of the story of the Passion; and, whether Prof. Huxley is inclined to argue about them or not, he will find that all serious people will be influenced by them to the end of time, unless they can be shown to be unhistorical.

At all events, by refusing to consider their import, Prof. Huxley has again, in the most flagrant manner, evaded my challenge. I not only mentioned specifically "the story of the Passion," but I explained what I meant by it; and Prof. Huxley asks us to believe that he does not understand what I referred to; he refuses to face that story; and he raises an irrelevant issue about the resurrection. It is irrelevant, because the point specifically at issue between us is not the truth of the Christian creed, but the meaning of agnosticism, and the responsibilities which agnosticism involves. I say that whether agnosticism be justifiable or not, it involves a denial of the beliefs in which Jesus lived and died. It would equally involve a denial of them had he never risen; and if Prof. Huxley really thinks, therefore, that a denial of the resurrection affects the evidence afforded by the Passion, he must be incapable of distinguishing between two successive and entirely distinct occurrences.

But the manner in which Prof. Huxley has treated this irrelevant issue deserves perhaps a few words, for it is another characteristic specimen of his mode of argument. I note, by the way,

that, after referring to "the facts of the case as stated by the oldest extant narrative of them"—he means the story in St. Mark, though this is not a part of that common tradition of the three Gospels on which he relies; for, as he observes, the accounts in St. Matthew and St. Luke present marked variations from it—he adds:

> I do not see why any one should have a word to say against the inherent probability of that narrative; and, for my part, I am quite ready to accept it as an historical fact, that so much and no more is positively known of the end of Jesus of Nazareth.

We have, then, the important admission that Prof. Huxley has not a word to say against the historic credibility of the narrative in the fifteenth chapter of St. Mark, and accordingly he proceeds to quote its statements for the purpose of his argument. That argument, in brief, is that our Lord might very well have survived his crucifixion, have been removed still living to the tomb, have been taken out of it on the Friday or Saturday night by Joseph of Arimathea, and have recovered and found his way to Galilee. So much Prof. Huxley is prepared to believe, and he asks "on what grounds can a reasonable man be asked to believe any more?" But a prior question is on what grounds can a reasonable man be asked to believe as much as this? In the first place, if St. Mark's narrative is to be the basis of discussion, why does Prof. Huxley leave out of account the scourging, with the indication of weakness in our Lord's inability to bear his cross, and treat him as exposed to crucifixion in the condition simply of "temperate, strong men, such as the ordinary Galilean peasants were"? In the next place, I am informed by good medical authority that he is quite mistaken in saying that "no serious physical symptoms need at once arise from the wounds made by the nails in the hands and feet," and that, on the contrary, very grave symptoms would ordinarily arise in the course of no long time from such severe wounds, left to fester, with the nails in them, for six hours. In the third place, Prof. Huxley takes no account of the piercing of our Lord's side, and of the appearance of blood and water from the wound, which is solemnly attested by one witness. It is true that incident is not recorded by St. Mark; but Prof. Huxley must disprove the witness before he can leave it out of account. But, lastly, if Prof. Huxley's account of the matter be true, the first preaching of the church must have been founded on a deliberate fraud, of which some at least of our Lord's most intimate friends were guilty, or to which they were accessory; and I thought that supposition was practically out of account among reasonable men. Prof. Huxley argues as if he had only to deal with the further evidence of St. Paul. That, indeed, is evidence

of a far more momentous nature than he recognizes; but it is by no means the most important. It is beyond question that the Christian society, from the earliest moment of its existence, believed in our Lord's resurrection. Baur frankly says that there is no doubt about the church having been founded on this belief, though he can not explain how the belief arose. If the resurrection be a fact, the belief is explained; but it is certainly not explained by the supposition of a fraud on the part of Joseph of Arimathea. As to Prof. Huxley's assertion that the accounts in the three Gospels are "hopelessly discrepant," it is easily made and as easily denied; but it is out of all reason that Prof. Huxley's bare assertion on such a point should outweigh the opinions of some of the most learned judges of evidence, who have thought no such thing. It would be absurd to attempt to discuss that momentous story as a side issue in a review. It is enough to have pointed out that Prof. Huxley discusses it without even taking into account the statements of the very narrative on which he relies. The manner in which he sets aside St. Paul is equally reckless:

> According to his own showing, Paul, in the vigor of his manhood, with every means of becoming acquainted, at first hand, with the evidence of eye-witnesses, not merely refused to credit them, but "persecuted the Church of God and made havoc of it." . . . Yet this strange man, because he has a vision one day, at once, and with equally headlong zeal, flies to the opposite pole of opinion.

"A vision!" The whole question is, what vision? How can Prof. Huxley be sure that no vision could be of such a nature as to justify a man in acting on it? If, as we are told, our Lord personally appeared to St. Paul, spoke to him, and gave him specific commands, was he to disbelieve his own eyes and ears, as well as his own conscience, and go up to Jerusalem to cross-examine Peter and John and James? If the vision was a real one he was at once under orders, and had to obey our Lord's injunctions. It is, to say the least, rash, if not presumptuous, for Prof. Huxley to declare that such a vision as St. Paul had would not have convinced him; and, at all events, the question is not disposed of by calling the manisfestation "a vision." Two things are certain about St. Paul. One is that he was in the confidence of the Pharisees, and was their trusted agent in persecuting the Christians; and the other is that he was afterward in the confidence of the apostles, and knew all their side of the case. He holds, therefore, the unique position of having had equal access to all that would be alleged on both sides; and the result is that, being fully acquainted with all that the Pharisees could urge against the resurrection, he nevertheless gave up his whole life to attesting its truth, and threw in his lot, at the cost of martyrdom, with those whom he had formerly persecuted. Prof. Huxley reminds us that he did all this in the full vigor of manhood, and in

spite of strong and even violent prejudices. This is not a witness to be put aside in Prof. Huxley's off-hand manner.

But the strangest part of Prof. Huxley's article remains to be noticed; and, so far as the main point at issue between us is concerned, I need hardly have noticed anything else. He proceeds to a long and intricate discussion, quite needless, as I think, for his main object, respecting the relations between the Nazarenes, Ebionites, Jewish and Gentile Christians, first in the time of Justin Martyr and then of St. Paul. Into this discussion, in the course of which he makes assumptions which, as Holtzmann will tell him, are as much questioned by the German criticism on which he relies as by English theologians, it is unnecessary for me to follow him. The object of it is to establish a conclusion, which is all with which I am concerned. That conclusion is that "if the primitive Nazarenes of whom the Acts speak were orthodox Jews, what sort of probability can there be that Jesus was anything else?"* But what more is necessary for the purpose of my argument? To say, indeed, that this *a priori* probability places us "in a position to form a safe judgment of the limits within which the teaching of Jesus of Nazareth must have been confined," is to beg a great question, for it assumes that our Lord could not have transcended those limits unless his disciples transcended them simultaneously with him. But if our Lord's beliefs were those of an orthodox Jew, we certainly know enough of them to be quite sure that they involved a denial of Prof. Huxley's agnosticism. An orthodox Jew certainly believed in God, and in his responsibility to God, and in a divine revelation and a divine law. It is, says Prof. Huxley, "extremely probable" that he appealed "to those noble conceptions of religion which constituted the pith and kernel of the teaching of the great prophets of his nation seven hundred years earlier." But, if so, his first principles involved the assertion of religious realities which an agnostic refuses to acknowledge. Prof. Huxley has, in fact, dragged his readers through this thorny question of Jewish and Gentile Christianity in order to establish, at the end of it, and, as it seems, quite unconsciously, an essential part of the very allegation which I originally made. I said that a person who "knows nothing" of God asserts the belief of Jesus of Nazareth to have been unfounded, repudiates his example, and denies his authority. Prof. Huxley, in order to answer this contention, offers to prove, with great elaboration, that Jesus was an orthodox Jew, and consequently that his belief did involve what an agnostic rejects. How much beyond these elementary truths Jesus taught is a further and a distinct question. What I was concerned to maintain is that a man can not be an agnostic with

* "Popular Science Monthly" for June, 1889, p. 184.

respect to even the elementary truths of religion without rejecting the example and authority of Jesus Christ; and Prof. Huxley, though he still endeavors to avoid facing the fact, has established it by a roundabout method of his own.

I suppose I must also reply to Prof. Huxley's further challenge respecting my belief in the story of the Gadarene swine, though the difficulty of which he makes so much seems to me too trivial to deserve serious notice. He says "there are two stories, one in 'Mark' and 'Luke,' and the other in 'Matthew.' In the former there is one possessed man, in the latter there are two," and he asks me which I believe? My answer is that I believe both, and that the supposition of there being any inconsistency between them can only arise on that mechanical view of inspiration from which Prof. Huxley seems unable to shake himself free. Certainly "the most unabashed of reconcilers can not well say that one man is the same as two, or two as one"; but no one need be abashed to say that the greater number includes the less, and that if two men met our Lord, one certainly did. If I go into the operating theatre of King's College Hospital, and see an eminent surgeon perform a new or rare operation on one or two patients, and if I tell a friend afterward that I saw the surgeon perform such and such an operation on a patient, will he feel in any perplexity if he meets another spectator half an hour afterward who says he saw the operation performed on two patients? All that I should have been thinking of was the nature of the operation, which is as well described by reference to one patient as to half a dozen; and similarly St. Mark and St. Luke may have thought that the only important point was the nature of the miracle itself, and not the number of possessed men who were the subjects of it. It is quite unnecessary, therefore, for me to consider all the elaborate dilemmas in which Prof. Huxley would entangle me respecting the relative authority of the first three Gospels. As two includes one, and as both witnesses are in my judgment equally to be trusted, I adopt the supposition which includes the statements of both. It is a pure assumption that inspiration requires verbal accuracy in the reporting of every detail, and an assumption quite inconsistent with our usual tests of truth. Just as no miracle has saved the texts of the Scriptures from corruption in secondary points, so no miracle has been wrought to exclude the ordinary variations of truthful reporters in the Gospel narratives. But a miracle, in my belief, has been wrought in inspiring four men to give, within the compass of their brief narratives, such a picture of the life and work and teaching, of the death and resurrection, of the Son of man as to illuminate all human existence for the future, and to enable men "to believe that Jesus is the Christ, and believing to have life through his name."

It is with different feelings from those which Prof. Huxley provokes that I turn for a while to Mrs. Humphrey Ward's article on "The New Reformation." Since he adopts that article as a sufficient confutation of mine, I feel obliged to notice it, though I am sorry to appear in any position of antagonism to its author. Apart from other considerations, I am under much obligation to Mrs. Ward for the valuable series of articles which she contributed to the "Dictionary of Christian Biography" under my editorship, upon the obscure but interesting history of the Goths in Spain. I trust that, in her account of the effect upon Robert Elsmere and Merriman of absorption in that barbarian scene, she is not describing her own experience and the source of her own aberrations. But I feel especially bound to treat her argument with consideration, and to waive any opposition which can be avoided. I am sorry that she, too, questions the possibility in this country of "a scientific, that is to say, an unprejudiced, an unbiased study of theology, under present conditions," and I should have hoped that she would have had too much confidence in her colleagues in the important work to which I refer than to cast this slur upon them. Their labors have, in fact, been received with sufficient appreciation by German scholars of all schools to render their vindication unnecessary; and if Prof. Huxley can extend his study of German theological literature much beyond Zeller's "Vorträge" of "a quarter of a century ago," or Ritschl's writings of "nearly forty years ago," he will not find himself countenanced by church historians in Germany in his contempt for the recent contributions of English scholars to early church history. However, it is the more easy for me to waive all differences of this nature with Mrs. Ward, because it is unnecessary for me to look beyond her article for its own refutation. Her main contention, or that at least for which Prof. Huxley appeals to her, seems to be that it is a mistake to suppose that the rationalistic movement of Germany has been defeated in the sphere of New Testament criticism, and she selects more particularly for her protest a recent statement in the "Quarterly Review" that this criticism, and particularly the movement led by Baur, is "an attack which has failed." The Quarterly Reviewer may be left to take care of himself; but I would only ask what is the evidence which Mrs. Ward adduces to the contrary? It may be summed up in two words—a prophecy and a romance. She does not adduce any evidence that the Tübingen school, which is the one we are chiefly concerned with, did not fail to establish its specific contentions; on the contrary, she says that "history protested," and she goes on to prophesy the success of other speculations which arose from that protest, concluding with an imaginary sketch, like that with which "Robert Elsmere" ends, of a "new Reformation preparing,

struggling into utterance and being, all around us. . . . It is close upon us—it is prepared by all the forces of history and mind—its rise sooner or later is inevitable." This is prophesy, but it is not argument; and a little attention to Mrs. Ward's own statements will exhibit a very different picture. The Christian representative in her dialogue exclaims:

> What is the whole history of German criticism but a series of brilliant failures, from Strauss downward? One theorist follows another—now Mark is uppermost as the Ur-Evangelist, now Matthew—now the Synoptics are sacrificed to St. John, now St. John to the Synoptics. Baur relegates one after another of the Epistles to the second century because his theory can not do with them in the first. Harnack tells you that Baur's theory is all wrong, and that Thessalonians and Philippians must go back again. Volkmar sweeps together Gospels and Epistles in a heap toward the middle of the second century as the earliest date for almost all of them; and Dr. Abbott, who, as we are told, has absorbed all the learning of the Germans, puts Mark before 70 A. D., Matthew just about 70 A. D., and Luke about 80 A. D.; Strauss's mythical theory is dead and buried by common consent; Baur's tendency theory is much the same; Renan will have none of the Tübingen school; Volkmar is already antiquated; and Pfleiderer's fancies are now in the order of the day.

A better statement could hardly be wanted of what is meant by an attack having failed, and now let the reader observe how Merriman in the dialogue meets it. Does he deny any of those allegations? Not one. "Very well," he says, "let us leave the matter there for the present. Suppose we go to the Old Testament"; and then he proceeds to dwell on the concessions made to the newest critical school of Germany by a few distinguished English divines at the last Church Congress. I must, indeed, dispute her representation of that rather one-sided debate as amounting to "a collapse of English orthodoxy," or as justifying her statement that "the Church of England practically gives its verdict" in favor, for instance, of the school which regards the Pentateuch or the Hexateuch as "the peculiar product of that Jewish religious movement which, beginning with Josiah, . . . yields its final fruits long after the exile." Not only has the Church of England given no such verdict, but German criticism has as yet given no such verdict. For example, in the introduction to the Old Testament by one of the first Hebrew scholars of Germany, Prof. Hermann Strack, contained in the valuable "Hand-book of the Theological Sciences," edited, with the assistance of several distinguished scholars, by Prof. Zöchler, I find, at page 215 of the third edition, published this year, the following brief summary of what, in Dr. Strack's opinion, is the result of the controversy so far:

> The future results of further labors in the field of Pentateuch criticism can not, of course, be predicted in particulars. But, in spite of the great assent which the view of Graf and Wellhausen at present enjoys, we are nevertheless convinced that it will not permanently lead to any essential alteration in the conception which has

hitherto prevailed of the history of Israel, and in particular of the work of Moses. On the other hand, one result will certainly remain, that the Pentateuch was not composed by Moses himself, but was compiled by later editors from various original sources. . . . But the very variety of these sources may be applied in favor of the credibility of the Pentateuch.

In other words, it may be said that Dr. Strack regards it as established that "The Law of Moses" is a title of the same character as "The Psalms of David," the whole collection being denominated from its principal author. But he is convinced that the general conclusions of the prevalent school of Old Testament criticism, which involve an entire subversion of our present conceptions of Old Testament history, will not be maintained. In the face of this opinion, it does not seem presumptuous to express an apprehension that the younger school of Hebrew scholars in England, of whose concessions Mrs. Ward makes so much, have gone too far and too fast; and, at all events, it is clear from what Dr. Strack says—and I might quote also Delitzsch and Dillmann—that it is much too soon to assume that the school of whose conquests Mrs. Ward boasts is supreme. But, even supposing it were, what has this to do with the admitted and undoubted failures on the other side, in the field of New Testament criticism? If it be the fact, as Mrs. Ward does not deny, that not only Strauss's but Baur's theories and conclusions are now rejected; if it has been proved that Baur was entirely wrong in supposing the greater part of the New Testament books were late productions, written with a controversial purpose, what is the use of appealing to the alleged success of the German critics in another field? If Baur is confuted, he is confuted, and there is an end of his theories; though he may have been useful, as rash theorizers have often been, in stimulating investigation. In the same valuable hand-book of Dr. Zöchler's, already quoted, I find, under the "History of the Science of Introduction to the New Testament," the heading (page 15, vol. i, part 2), "Result of the controversy and end of the Tübingen school."

The Tübingen school (the writer concludes, p. 20) could not but fall as soon as its assumptions were recognized and given up. As Hilgenfeld confesses, "it went to an unjustifiable length, and inflicted too deep wounds on the Christian faith. . . . No enduring results in matters of substance have been produced by it."

Such is the judgment of an authoritative German hand-book on the writer to whom, in Merriman's opinion, "we owe all that we really *know* at the present moment about the New Testament," as though the Christian thought and life of eighteen hundred years had produced no knowledge on that subject!

In fact, Mrs. Ward's comparison seems to me to point in exactly the opposite direction:

I say to myself (says her spokesman, p. 466) it has taken some thirty years for German critical science to conquer English opinion in the matter of the Old Testament. . . . How much longer will it take before we feel the victory of the same science . . . with regard to the history of Christian origins?

Remembering that the main movement of New Testament criticism in Germany dates not thirty, but more than fifty years back, and that thirty years ago Baur's school enjoyed the same applause in Germany as that of Wellhausen does now, does it not seem more in conformity with experience and with probability to anticipate that, as the Germans themselves, with longer experience, find they had been too hasty in following Baur, so with an equally long experience they may find they have been similarly too hasty in accepting Wellhausen? The fever of revolutionary criticism on the New Testament was at its height after thirty years, and the science has subsided into comparative health after twenty more. The fever of the revolutionary criticism of the Old Testament is now at its height, but the parallel suggests a similar return to a more sober and common-sense state of mind. The most famous name, in short, of German New Testament criticism is now associated with exploded theories; and we are asked to shut our eyes to this undoubted fact because Mrs. Ward prophesies a different fate for the name now most famous in Old Testament criticism. I prefer the evidence of established fact to that of romantic prophecy.

But these observations suggest another consideration, which has a very important bearing on that general disparagement of English theology and theologians which Prof. Huxley expresses so offensively, and which Mrs. Ward encourages. She and Prof. Huxley talk as if German theology were all rationalistic and English theology alone conservative. Prof. Huxley invites his readers to study in Mrs. Ward's article

the results of critical investigation as it is carried out among those theologians who are men of science and not mere counsel for creeds;

and he appeals to

the works of scholars and theologians of the highest repute in the only two countries, Holland and Germany, in which, at the present time, professors of theology are to be found, whose tenure of their posts does not depend upon the results to which their inquiries lead them.

Well, passing over the insult to theologians in all other countries, what is the consequence of this freedom in Germany itself? Is it seen that all learned and distinguished theologians in that country are of the opinions of Prof. Huxley and Mrs. Ward? The quotations I have given will serve to illustrate the fact that the exact contrary is the case. If any one wants vigorous, learned, and satisfactory answers to Prof. Huxley and Mrs. Ward, Ger-

many is the best place to which he can go for them. The professors and theologians of Germany who adhere substantially to the old Christian faith are at least as numerous, as distinguished, as learned, as laborious, as those who adhere to skeptical opinions. What is, by general consent, the most valuable and comprehensive work on Christian theology and church history which the last two generations of German divines have produced? Herzog's "Real-Encyclopädie für protestantische Theologie und Kirche," of which the second edition, in eighteen large volumes, was completed about a year ago. But it is edited and written in harmony with the general belief of Protestant Christians. Who have done the chief exegetical work of the last two generations? On the rationalistic side, though not exclusively so, is the "Kurzgefasstes exegetisches Handbuch," in which, however, at the present time, Dillmann represents an opposition to the view of Wellhausen respecting the Pentateuch; but on the other side we have Meyer on the New Testament—almost the standard work on the subject—Keil and Delitzsch on the Old Testament and a great part of the New, Lange's immense "Bibelwerk," and the valuable "Kurzgefasster Kommentar" on the whole Scripture, including the Apocrypha, now in course of publication under the editorship of Profs. Strack and Zöckler. The Germans have more time for theoretical investigations than English theologians, who generally have a great deal of practical work to do; and German professors, in their numerous universities, in great measure live by them. But it was by German theologians that Baur was refuted; it is by German Hebraists like Strack that Wellhausen and Kuenen are now being best resisted. When Prof. Huxley and Mrs. Ward would leave an impression that, because German theological chairs are not shackled by articles like our own, therefore the best German thought and criticism is on the rationalistic side, they are conveying an entirely prejudiced representation of the facts. The effect of the German system is to make everything an open question; as though there were no such thing as a settled system of the spiritual universe, and no established facts in Christian history; and thus to enable any man of great ability with a skeptical turn to unsettle a generation and leave the edifice of belief to be built up again. But the edifice *is* built up again, and Germans take as large a part in rebuilding it as in undermining it. Because Prof. Huxley and Mrs. Ward can quote great German names on one side, let it not be forgotten that just as able German names can be quoted on the other side. Take, for instance, Harnack, to whom Mrs. Ward appeals, and whose "History of Dogmas" Prof. Huxley quotes. Harnack himself, in reviewing the history of his science, pays an honorable tribute to the late eminent divine, Thomasius, whose "History of Dogmas" has just

been republished after his death, and who wrote in the devoutest spirit of the Lutheran communion. Of course, Harnack regards his point of view as narrow and unsatisfactory; but he adds that, "equally great are the valuable qualities of this work in particular, in regard of its exemplarily clear exposition, its eminent learning, and the author's living comprehension of religious problems." A man who studies the history of Christian theology in Harnack without reference to Thomasius will do no justice to his subject.

But, says Mrs. Ward, there is no real historical apprehension in the orthodox writers, whether of Germany or England, and the whole problem is one of "historical translation." Every statement, every apparent miracle, everything different from daily experience, must be translated into the language of that experience, or else we have not got real history. But this, it will be observed, under an ingenious disguise, is only the old method of assuming that nothing really miraculous can have happened, and that therefore everything which seems supernatural must be explained away into the natural. In other words, it is once more begging the whole question at issue. Mrs. Ward accuses orthodox writers of this fallacy; but it is really her own. Merriman is represented as saying that he learned from his Oxford teachers that

> it was imperatively right to endeavor to disentangle miracle from history, the marvelous from the real, in a document of the fourth, or third, or second century; . . . but the contents of the New Testament, however marvelous and however apparently akin to what surrounds them on either side, were to be treated from an entirely different point of view. In the one case there must be a desire on the part of the historian to discover the historical under the miraculous, . . . in the other case there must be a desire, a strong "affection," on the part of the theologian, toward proving the miraculous to be historical.

Mrs. Ward has entirely mistaken the point of view of Christian science. Certainly if any occurrence anywhere can be explained by natural causes, there is a strong presumption that it ought to be so explained; for, though a natural effect may be due in a given case to supernatural action, it is a fixed rule of philosophizing, according to Newton, that we should not assume unknown causes when known ones suffice. But the whole case of the Christian reasoner is that the records of the New Testament defy any attempt to explain them by natural causes. The German critics Hase, Strauss, Baur, Hausrath, Keim, all have made the attempt, and each, in the opinion of the others, and finally of Pfleiderer, has offered an insufficient solution of the problem. The case of the Christian is not that the evidence ought not to be explained naturally and translated into every-day experience, but that it can not be. But it is Mrs. Ward who assumes beforehand

that simply because the "Life and Times of Jesus the Messiah," by that learned scholar and able writer, Dr. Edersheim, whose recent loss is so much to be deplored, does not "translate" all the Gospel narratives into natural occurrences, therefore it is essentially bad history. The story has been the same throughout. The whole German critical school, from the venerable Karl Hase —and, much as I differ from his conclusions, I can not mention without a tribute of respect and gratitude the name of that great scholar, the veteran of all these controversies, whose "Leben Jesu," published several years before Strauss was heard of, is still, perhaps, the most valuable book of reference on the subject —all, from that eminent man downward, have, by their own repeated confession, started from the assumption that the miraculous is impossible, and that the Gospels must, by some device or other, be so interpreted as to explain it away. "Affection" there is and ought to be in orthodox writers for venerable, profound, and consoling beliefs; but they start from no such invincible prejudice, and they are pledged by their principles to accept whatever interpretation may be really most consonant with the facts.

I have only one word to say, finally, in reply to Prof. Huxley. I am very glad to hear that he has always advocated the reading of the Bible and the diffusion of its study among the people; but I must say that he goes to work in a very strange way in order to promote this result. If he could succeed in persuading people that the Gospels are untrustworthy collections of legends, made by unknown authors, that St. Paul's epistles were the writings of "a strange man," who had no sound capacity for judging of evidence, or, with Mrs. Ward's friends, that the Pentateuch is a late forgery of Jewish scribes, I do not think the people at large would be likely to follow his well-meant exhortations. But I venture to remind him that the English Church has anticipated his anxiety in this matter. Three hundred years ago, by one of the greatest strokes of real government ever exhibited, the public reading of the whole Bible was imposed upon Englishmen; and by the public reading of the lessons on Sunday alone, the chief portions of the Bible, from first to last, have become stamped upon the minds of English-speaking people in a degree in which, as the Germans themselves acknowledge,* they are far behind us. He has too much reason for his lament over the melancholy spectacle presented by the intestine quarrels of churchmen over matters of mere ceremonial. But when he argues from this that the clergy of our day "can have but little sympathy with the old evangelical doctrine of the 'open Bible,'" he might have remembered that our own generation of English divines has, by the

* See the preface to Riehm's "Handwörterbuch."

labor of years, endeavored at all events, whether successfully or not, to place the most correct version possible of the Holy Scriptures in the hands of the English people. I agree with him most cordially in seeing in the wide diffusion and the unprejudiced study of that sacred volume the best security for "true religion and sound learning." It is in the open Bible of England, in the general familiarity of all classes of Englishmen and Englishwomen with it, that the chief obstacle has been found to the spread of the fantastic critical theories by which he is fascinated; and, instead of Englishmen translating the Bible into the language of their natural experiences, it will in the future, as in the past, translate them and their experiences into a higher and a supernatural region.—*Nineteenth Century.*

AN EXPLANATION TO PROF. HUXLEY.

By W. C. McGEE, Bishop of Peterborough.

IN the February number of this review Prof. Huxley put into the mouth of Mr. Frederic Harrison the following sentence: "In his [the agnostic's] place, as a sort of navvy leveling the ground and cleansing it of such poor stuff as Christianity, he is a useful creature who deserves patting on the back—on condition that he does not venture beyond his last." The construction which I put upon these words—and of which I still think them quite capable—was that the professor meant to represent Mr. Harrison and himself as agreed upon the proper work of the agnostic, and as differing only as to whether he might or might not "venture beyond" that. On this supposition, my inference that he had called Christianity "sorry," or, as I ought to have said, "poor stuff" (the terms are, of course, equivalent), would have been perfectly correct.

On re-reading the sentence in question, however, in connection with its context, I see that it may more correctly be regarded as altogether ironical; and this, from the professor's implied denial in his last article of the correctness of my version, I conclude that he intended it to be. I accordingly at once withdraw my statement, and express my regret for having made it. May I plead, however, as some excuse for my mistake, that this picture of himself when engaged in his agnostic labors is so wonderfully accurate and life-like that I might almost be pardoned for taking for a portrait what was only meant for a caricature, or for supposing that he had expressed in so many words the contempt which displays itself in so many of his utterances respecting the Christian faith?

Nevertheless I gladly admit that the particular expression I had ascribed to him is not to be reckoned among the already too numerous illustrations of what I had described as his "readiness to say unpleasant," and—after reading his last article—I must add, offensive, "things."

With this explanation and apology I take my leave of the professor and of our small personal dispute—small, indeed, beside the infinitely graver and greater issues raised in his reply to the unanswered arguments of Dr. Wace.

I do not care to distract the attention of the public from these to a fencing-match with foils between Prof. Huxley and myself. In sight of Gethsemane and Calvary such a fencing-match seems to me out of place.—*Nineteenth Century.*

FUNGI.

II.—MICROSCOPIC FORMS.*

By T. H. McBRIDE,

PROFESSOR OF BOTANY IN THE UNIVERSITY OF IOWA.

THE microscopic world is ever fair. In every department of research we revert to our instruments, certainly expecting to be charmed by beauty, whether of movement or mechanism. Rarely are we disappointed, certainly not in the realm of organic form. Here everything is beautiful, and, as the heavens to the astronomer, everything is clean. Even the rudest fungi offer no exception. In them the microscope finds no exception to the law of beauty. The simplicity of structure noted in the previous article runs through nearly all, only varied a thousand times; but whether mycelial thread or spores, one or other or both conjoined, the result, as we hope by illustration here to show, is always symmetry and elegance itself.

To begin, let us revert to the lilac-bush, whose whitened leaves may readily afford illustration of mycelial webs and threads. By September, if not sooner, the entire foliage will have taken on its peculiar whiteness as if thickly dusted with chalk or flour. On certain leaves, however, appear suspicious-looking dark-brown specks or grains, very small, but plainly visible to the naked eye. Removing some of these granules to the microscope, we find the field filled with tiny sculptured spheres ornamented with a profusion of long, interlocking filaments, starting out like so many extended radii of each sphere. A gentle pressure on the cover-glass breaks the sphere, and forthwith (Fig. 1) a dozen tiny sacs

* Illustrations from drawings by M. F. Linder and the author.

appear, each packed with transparent oval nucleated spores, just such spores and quite such sacs as appeared in the fruiting surface of the morel, and we are ready with the botanist to call the granules fruit. Who could have guessed the contents of that sphere? But look again at those radiating ornamental filaments. Trace to its distal end a single ray, and see the grapnels by which the fertile globule we have studied holds fast to the surface of its host through storm and flood. Notice the elegant curves, the symmetrical branching, fit model for the artist in arabesque or filigree! What more beautiful or more efficiently suggestive! (Fig. 2 *a*.)

Such is the lilac blight, but now that we have discoverd one such fungus, we may carry our inquiries to almost any extent. The neighboring cherry-tree will afford similar material for study and admiration. Here the appendages are simpler, and the fruit itself contains but a single sac with spores (Fig. 3 *a*). The poplars and the willows show spherules whose appendages are simple hooks, so that the fruit is a minute bur of the teazel sort, fit for fairy carding (Fig. 2 *b*). The oak-leaf and the hazel bear appendages simpler still, the appendages being straight and needle-shaped, ray-like, actinic; *Phyllactinia* Léveillé named it—leaf-ray—the needles starting like rays of light from some effulgent center (Fig. 3 *b*).

During the early days of autumn we can hardly go amiss for the appendaged fungi such as just described. In the woodland, the pastures, by the road-side, in shade and in sun, a thousand white-flecked leaves attract the appreciative and only the appreciative eye. Minuteness removes from ordinary ken—and the world goes on! Besides, these parasites are not especially harmful, at least in the phases described, to their presumably unwilling hosts. The pea-vine and the rose-bush may sometimes suffer, but generally the leaves attacked have pretty well done the season's work before the parasite attains its maximum, so that man's interest in the matter is not specially affected. There is, however, another and different set of leaf-fungi whose parasitism is decidedly more intimate, and consequently destructive of the host-plant, suicidal as such a policy would seem to be. These latter, as indeed all the fungi already cited, are known as blights, and as such some species are already famous. The potato murrain, which has its place in civil history, is a very pretty little transparent branching fungus, so delicate that a breath destroys it. First becoming notorious in 1845, and during the famines of 1846 and 1847, it has been found and studied in all parts of the world for the forty years succeeding. The lilac fungus is content to spread its mycelium over the surface of the lilac-leaves, absorbing its nourishment from the surface cells; but the potato mold,

the *Phytophthora infestans* of the books, seems to reach every cell and every tissue, so that a whole potato-field once infested will go down as if smitten by the frost of night. Kindred fungi are upon many of the plants about us. *Peronospora viticola* attacks the leaves of the grape. In wet seasons it is not uncommon to see the wild grape-vines along our western streams completely white with this overwhelming assailant, nor are our Concord vineyards ever quite exempt. The mycelial filaments thread the soft interior tissues while fruiting hyphæ come forth in delicate tufts or pencils through the open stomata on the under surface of the leaf. It is pleasant to think that weeds of various kinds suffer from similar fungal invasions. Thus goosefoot (*Chenopodium, sp.*) bears every spring upon its earlier leaves a tiny parasite, which seen under our lenses seems a miniature forest, while the fruit masses itself in violet tinted patches plainly to be seen by the naked eye.

Even the evergreens, the cone-bearers, that ancient race of hardy conservatives, are compelled to pay tithes and tribute to these all-assailing Vandals. I suppose the cedars of Lebanon are not exempt! At all events, who has not seen our native cedars bending after some warm shower in June with orange-colored fruit, beautiful, but to the cedar costly as it is fair? (Fig. 4 *a*.) Cedar-apples, men say, and they are not a few who would insist that the cedar is actually blooming and fruiting. Such fruit has actually been planted—vain expectation. Cedar-apples are but the excrescences caused by the persistent development of a fungus parasitic upon branch or leaf; they are receptacles from which the fungus throws out at a favorable moment gelatinous masses of orange-colored spores (Fig. 4 *b*). No fruit of the cedar are apples such as these, fruit rather of the cedar's malignant foe. Trees are sometimes seen whose crop of "apples" becomes so heavy that disaster almost to extinction marks successive years. Strange to say, the cedar does not bear its affliction alone. The hawthorn has a part in the matter, and on its leaves are borne fringed cups of fungal fruit supplemental to the cedar's parasite, just as the cluster-cups on the barberry-leaves are congeners of the rusts on fields of standing grain. In fact, with these microscopic forms parasitism is the rule, whether as affecting the vegetable world as we have seen, or in more insidious guise assailing the animal as well, when bacteria and bacilli in phantom myriads appear to baffle surgery and sanitary science. Here, as has been well said, is "the arrow that flieth by day; the pestilence that walketh at noonday." The discussions of a decade have rendered these organisms familiar, at least by name, to every reader. Every wise physician is an experimenter in the field. A new literature has grown up, to which the scientific world makes daily contri-

butions, and bacteriology is hailed the latest phase of biologic science. Nevertheless, the subject is as yet only touched upon. We have simply begun to find out how to study these minutest forms, some of which may yet be hiding beyond our utmost microscopic vision.

But the most remarkable group of fungoid organisms remains yet to be considered—remarkable alike because of the innate novelty and beauty of the objects themselves, and because of the difficulty which seems ever likely to attend any effort to fix exactly their place in classification. Among English writers the organisms in question are called slime-molds; in science they have received as a group different appellations. The slime-molds are sufficiently common in all the wooded regions of the globe, although receiving less attention on account of minuteness and unobtrusiveness. With most of the species it is a plain case of "*seek* and thou shalt find." Some, however, are quite large, as, for instance, one of the simplest appearing often in summer flowing up between the planks of our familiar board walks, for be it understood at the outset that the slime-molds are, in one stage at least, soft, protoplasmic bodies possessed of locomotive powers, changing form with protean incertitude, and position with nonchalance far from reassuring. The species in question appears then, in quantity, a patch of brownish, frothy-looking matter, not attractive. Scrape it away, and probably more will take its place, furnished forth from the moist, dark chambers underneath. Leave it a few hours, and you return to find a mass of purplish dust, overarched, perchance, by a porous crust of yellowish color and fragile structure. This dust is fruit, spores we may say, and we wonder what may be the destiny of spores formed in so strange a fashion. Place a few of these spores in a moist chamber, and in a short time each germinates and produces—a mycelial thread? Not at all; on the contrary, a protoplasmic particle, not to be distinguished from that other protoplasmic bit men call Amœba. When these Amœbæ, produced by the germinating spores, have for a time pursued each his individual way, all under favoring circumstances reassemble, coalesce, actually blending, in most

FIG. 1.—FRUIT OF LILAC BLIGHT, × 300.

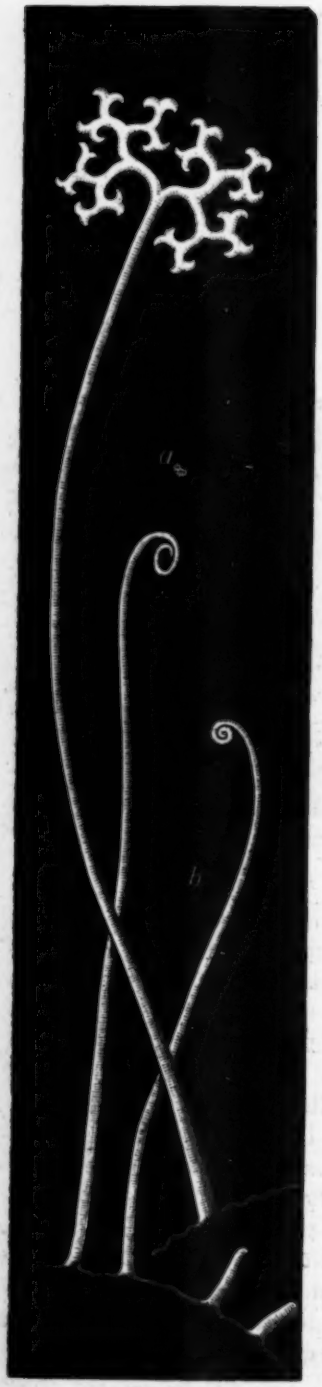

FIG. 2.

cases, to produce a new slime-mold in all respects comparable to its polymorphic ancestry, a new motile organism ready once more to break up into spores and fruit, and so continue its never-ending cycle of purposeless existence. I say purposeless, for there seems to be no outlet, no outlook toward anything better or higher. Its relations look backward, not forward, and we connect it with the lowest forms of animal life more easily than with anything else. Hence the difficulty of the systematist. Animals they can hardly be, for nowhere else in the kingdom are animals reproduced by spores, to say nothing of the forms of fruiting described later on. We call them for convenience fungi; yet, while some fungi are destitute of mycelium, and some produce swarm spores or motile naked amœboid spores, still in no instance do these behave as in the slime-mold.

It is interesting to notice the gingerly manner in which naturalists in their discussions approach these forms. Sachs throws in a chapter, nowhere in particular, a sort of addendum on *Myxomycetes*. De Bary, the lamented, gives us his masterpiece on fungi, "*including the Mycetozoa*," and in speaking of their relationship says, "For various reasons, which, according to the knowledge at hand, have from time to time been more or less closely worked out, I have, since 1858, placed the *Myxomycetes* (slime-molds) under the name *Mycetozoa* outside the vegetable kingdom, and this I still consider their proper place."* He does not call the organisms *animals*, be it observed. If a zoölogist chooses to do so, De Bary makes no objection. Meanwhile, Saville Kent, zoölogist, encouraged probably by De Bary's position, comes forward in

* De Bary, "Morphology and Biology of Fungi," p. 478.

his "Manual of Infusoria" and claims the whole series as animals; while Cooke, as representing the English botanists, says, in the introduction to "Myxomycetes of Great Britain," "It is unnecessary to attempt any controversion of the proposition once made, but soon ignored, that these organisms are more intimately related to animals than plants."* And Saccardo, in his great work now appearing, "Sylloge Fungorum," enumerates and describes the *Myxomycetes* with the rest.

But while systematists thus differ as to the place the slime-molds should have in classification, we need not hesitate to enjoy their beautiful forms. They *are*, whether we know *what* they are or not. The sidewalk species is very strange, and the transition from slime to dusty spores would be incredible did we not witness it. Stranger still, however, is the case of a species often brought in midsummer from the woods. Here, as the object comes from the forest, is a mass of yellowish slime without apparent structure or parts, "without form or comeliness." We lay it upon the laboratory table, shut it up in a box, if you choose, and a few days later examine to find no end of structure. Every particle appears to have passed into the composition of definite and elegant machinery. A perfect honey-comb now lies upon the bit of rotten wood, the original support, each cell capped with a filmy lid which seems all too fragile, and which, opening here and there, discloses a powdery, fluffy mass within. Brought to the microscope, the contents of each cell spread out in fruit, in spores and banded filaments, "elaters" called, to whose beauty our drawing (Fig. 5) pays but distant tribute. Golden is the color, sculptured

FIG. 3.

* Cooke's "Myxomycetes of Great Britain," introduction, p. iii.

are the spores, and twisted are the filaments with many a delicate spiral wound, the coils running transverse to certain finer striæ, as if the whole structure did but make appeal to some æsthetic eye. Slime-mold it was before, *Trichia chrysosperma* now, and, so far as may be seen, simple evaporation has wrought the change.

Fig. 6 illustrates the fruit of another slime-mold which, during the present year, has been extremely common in this vicinity. Abundant rains during the summer were, perchance, the stimulating cause. On oak-stumps of four or five years' standing there appeared glistening patches of the size of one's hand, by no means attractive to the casual observer; rather the reverse. Presently the entire mass heaped itself up, becoming, say, four tenths of an inch in depth; a thin film covered all, and desiccation began. Shortly the entire mass had been transformed. Hundreds of slender columnar receptacles, each mounted upon the most delicate little, black, shining pedicle or stalk, and crowded with spores, completely replaced that mass of slime, leaving scarcely a trace. The upper film breaks away, and a thousand delicate, plume-like structures wave a diminutive forest (Fig. 6). Each tiny stalked receptacle is a spore-case with lace-like walls of richest color, and is at first packed with unicellular sporules of the same deep tint. The entire fruit resembles somewhat a stamen, hence the name, *Stemonitis* (like a stamen). Other fungi, of the same type as

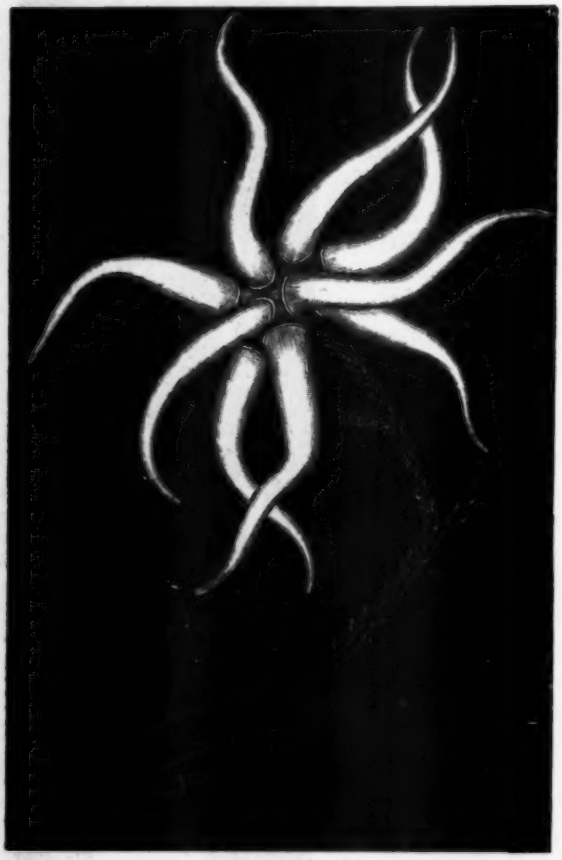

FIG. 4.—"CEDAR-APPLE" AND SPORES—the latter highly magnified.

stemonitis, only more delicate still both in form and color, are not infrequent. They are everywhere in the woodland—on leaves and sticks that lie close upon the ground, upon a thousand humblest things. Such forms are the *Comatrichæ*, *Arcyriæ*, *Cribrariæ*, etc. The arcyrias form their spores and the net which contains them all in a delicate spherical or obconical receptacle.* At maturity the upper part breaks away and the elasticity of the contained structures forces them out as a most airy puff, from which the spores may be driven by the wind while the base of the original envelope remains as an empty cup. Sometimes the entire structure is mounted upon a slender, polished stalk of appreciable length, and the whole colony of sporangia stand as tiny salvers whose shadowy contents rise like incense-wreaths. To find a rosy field of *Arcyria puniceum*, to safely box it and lodge it in one's collection, is enough to give a man joy, even of the æsthetic sort, from Sunday to Sunday. The tints in all these fruits are just right: they are the grays, the olives, the brick-reds, the browns, and yellows.

FIG. 5.—SPORES AND ELATERS OF TRICHIA CHRYSOSPERMA. Highly magnified.

Of these that produce their fruit thus in spherical or cup-shaped receptacles, some are giants among the rest. One, very common, imitates the *Lycoperdons*, or puff-balls, and that so closely as to have deceived the botanists themselves. It has been named *Lycoperdon* again and again, and even carried over the whole tribe with which it is related into the order *Gasteromycetes*—the puff-ball order. The student finds a row of little spheres, ashy or rosy in color, about as large as bullets, resting side by side on some bit of rotten stuff in the woods, and forthwith thinks about *Lycoperdon pusillum*, or possibly some new species, and not until after much investigation and groping, and probably some outside assistance, does he at length reach the "true inwardness" of *Lycogala*.

* *Stemonitis* also has at one time in its development a delicate peridium around each sporangium. This, however, soon vanishes.

The more we study these wonderful organisms, the more surprising it seems that two such very different phases should coexist in the same organism and succeed each other so abruptly. We no longer wonder at the perplexity of the systematists, and we can but admire the reckless courage of Saccardo, who discusses the slime-molds in his volume vii, "Sylloge Fungorum," along with other myceliumless forms, and says never so much as "By your leave."

FIG. 6.—STEMONITIS FUSCA. Central figure × 2; detail and spores more highly magnified.

Before the vision of the biologist there rises ever more that weird limbo where "*men*" appear "as *trees* walking." Whether, as in that elder case, experience may bring clearer vision, time alone can tell. Plant and animal have doubtless somewhere a common starting-ground. Toward that common origin the *Myxomycetes* undoubtedly point. They are not it. They seem rather to represent an independent twig near the base of the great tree of life, a branchlet whose departure was absolute as ancient, developing with no respect to any other organic thing, and soon reaching the limit of that particular possibility. Perfect in themselves, we may look for nothing further in that direction. Nature herself has written, "No thoroughfare."

FIG. 7.—ARCYRIA PUNICEA. Detail and spores highly magnified.

In conclusion, we may notice the question of utility which doubtless rises in some minds. To what end are all these microscopic bits of stuff organic thus hidden from ordinary ken? To such a query no real answer can be given. Our systems of economics are nowhere sufficiently refined, our tests of value show no balances whose

delicacy trembles to a case like this. What know we of Nature's infinite equipoise? Such organisms are their own excuse for being, and, if by any chance they serve at length the æsthetic sense of some creature intellectual, his is the good fortune; their destiny waxes not nor wanes.

THE ARTIFICIAL PROPAGATION OF SEA-FISHES.

By Prof. W. K. BROOKS,
of Johns Hopkins University.

SOME years since the writer was much impressed by an article by Prof. Huxley, in "The Popular Science Monthly," on the artificial propagation of food-fishes, in which he recognizes the value of the economic results which have followed the culture of the fishes of inland waters, but gives very emphatic expression to his belief that man's influence, either for good or for bad, upon the infinite wealth of the ocean, is so very slight as to be absolutely without significance. He argues that an oceanic species which is rich enough in individuals to resist all the enemies which prey upon it can be in no danger from man. If, he says, it is able to hold its own in the fierce struggle with the natural conditions of its existence, the loss of the few individuals, which are all that the human fishermen are able to capture, can not possibly lead to its extermination, nor even exert any noteworthy influence upon its abundance; nor can man, he argues, by artificially fertilizing a few million eggs, and by rearing a few million young fishes, cause any appreciable increase in the abundance of a species which includes countless millions of adult fishes, each of which has the power to leave behind it millions of descendants.

As compared with the natural reproductive power of the cod-fishes upon the Grand Banks, the efforts of man to artificially increase the supply sink into absolute insignificance, and Huxley's statement of the case seemed to me at the time to be convincing; but I have recently been able to investigate the subject for myself, and I am now satisfied that his opinions are not beyond question. As I am well aware that their influence has been far-reaching, and has much to do with current views, I take this opportunity to state my reasons for the change in my own opinion, as I wish to call attention to what I now consider a serious fallacy in his argument. If man's destructive influence were similar in kind to that of the other enemies of marine food-fishes, it would undoubtedly be quite true that the numbers destroyed by him are as nothing when compared with those which are destroyed in other ways; but the danger which comes from man's

influence is fundamentally different from all the natural dangers to which sea-fishes are exposed, since it is modern or recent, and has, therefore, failed to be recognized and provided against during the evolution of these animals. In this sense man's influence is *unnatural*, while all other dangers are *natural*. The danger from man is not only modern, but also totally anomalous in the rapidity of its approach. It has not grown up gradually and imperceptibly, but has swept over the entire ocean with a speed which leaves no chance for the production of compensating adjustments by the slow process of selection. If it were to remain without change, or were to change very slowly, there can be no doubt that all the species which were not quickly destroyed would ultimately be brought into adjustment, and would from that time on be able to resist; but what animal can become adjusted to an enemy who is able, in less than a generation, to increase his power by such inventions as the steamboat, the electric light, and the dynamite bomb? To marine food-fishes man is a catastrophe, not a natural enemy, and the natural methods of maintaining the harmony between oceanic animals and the slow geologic changes of the ocean bottom are of no avail against him.

A study of the destructive forces of nature shows that man is peculiar in other all-essential particulars. It is a well-known fact that of all the marine animals which fall a prey to enemies, or become the victims of accidents and diseases, all but an infinitesimal percentage are destroyed during infancy or youth. As soon as the eggs of a fish are laid, the process of decimation begins, and it is initiated on a scale which would quickly sweep the species out of existence if it lasted long; but, fortunately, it does not, and each day in the life of a young fish brings with it an enormous increase in the chance for a long life.

During the early stages of development the young fish is totally defenseless, and at the mercy of enemies and accidents; and, although each pelagic fish lays enormous numbers of eggs, not a single one could escape if the embryonic period were long. Natural selection has been constantly acting for untold ages to shorten it, however, for in each generation those eggs which developed most rapidly have most frequently escaped destruction; and as the fishes which hatched from these precocious eggs have inherited a tendency to produce similar eggs, the embryonic life has gradually grown short, and most pelagic eggs now develop so rapidly that it is not unusual for them to hatch within twenty-four hours after they are fertilized. After they are hatched the transparency and activity of the little fishes add greatly to their safety, although each school of young fishes is constantly encompassed on all sides by a host of enemies. I have found, by watching for an hour from the end of a wharf a school of some eight

hundred or a thousand young fishes, that one of them fell a victim each minute to the enemies of the air or of the water. While the death-rate is vastly less than it was during embryonic life, it is great enough to put an end to the entire school in a single day, were it not for the fact that each time a bird swoops down upon the little fishes out of the air above, and each time that a predacious fish darts in among them out of the depths and carries off a victim, the survivors profit by the new experience, and become more alert and vigilant and better able to escape future danger. While it is not possible to give figures, there can be no doubt that the chance for long life increases by a high geometrical ratio with age. Among salt-water fishes the death-rate is enormous at first, but it grows less and less as the individuals grow older; and the natural death-rate of adult fishes is infinitesimal as compared with the death-rate of the young. A high birth-rate has its advantages, since it gives an opportunity for selection, and thus contributes to the maintenance and gradual evolution and improvement of the standard of the race. Each adult fish is a survivor, picked out or naturally selected from among thousands or even millions of less favored brothers and sisters; and while many of the accidents which overwhelm the eggs and young are of such a character that individual peculiarities count for nothing against them, we can not doubt that, on the whole, the alert and energetic and intelligent fishes are most likely to escape, and to grow up to maturity and to bear descendants. A high rate of increase does unquestionably aid evolution by selection, but the well-known fact that it is reduced in all species with low death-rates shows that its primary and most important purpose is to compensate for the loss from accidents and diseases and enemies, and to insure the perpetuation of the species.

A young fish with a million brothers and sisters must, before it reaches sexual maturity, be in imminent peril of life a million times before it is able to reproduce its kind; and the million perils are so grouped that most of them face it at the beginning of its life, and grow less and less frequent as it becomes older. The perils of a fish may be compared to a pyramid which tapers from a broad base in infancy to a pointed apex in mature life, and each species must be made up of individuals of all ages in a similar numerical ratio to each other. The perils of each individual fish seem to be accidental, but their average for the entire species conforms to exact numerical laws, and the number which die during the first day, the second day, and so on, of their lives, must be about the same, season after season. During the slow process of evolution the birth-rate of each species has been so regulated by selection that, after the natural mortality has been provided for, there shall be enough survivors in each generation to maintain

the species and to keep the area which it inhabits stocked with as many adults as it can support.

All the natural sources of mortality are thus provided for. As each species is slowly and gradually brought into harmonious adjustment to the conditions of its environment, its birth-rate, like all its other attributes, is regulated and adapted to meet all the natural demands upon it. Now what happens if, after each one of the natural enemies has claimed its victims, a new enemy not provided for by Nature suddenly attacks the few adult survivors which Nature has provided to perpetuate the species? What happens when the last drop falls into the brimming bucket? What happens when the proverbial last straw is put on the load? It may be quite true that, for each codfish which man catches, the natural enemies destroy a million. That has no bearing on the subject. Nature has provided for the destruction of the million. Before their birth they were destined to premature death. The one was reserved by Nature for another purpose.

If the destructive influence of man had been gradually brought to bear, and had kept pace with the evolution of the species, natural selection would have provided a remedy, and the birth-rate would have been correspondingly increased; but this has not been the case; and, while man might not be able to make any impression on the broad base of the pyramid, we must remember that he does not attack the base, but the pointed apex. The fact that sea-fishes are so enormously prolific is entirely irrelevant. Their high birth-rate is an adjustment to their natural environment, while the influence of man is a new factor which has not been provided against.

It is difficult to get statistical information regarding marine animals, but there is ample evidence that they may be exterminated by man. The Bahama sponge-fishermen complain that they are now compelled to make long voyages and to visit remote banks for sponges which in former years could be gathered in abundance near the seaports. It is well known that, just before the oil from the wells of Pennsylvania came into common use, the sperm-whales had become so scarce that they were in imminent danger of extermination. The scarcity and the high price of sea-fishes in the vicinity of large seaport towns are unquestionable; and the shore-fisheries of the New England coast, to which Cape Cod owes its name, have been so completely destroyed that, when the Cape Cod fishermen caught, a few months ago, in their nets some of the young codfishes which had been hatched in the Fish Commission laboratory at Wood's Holl, they brought them to the naturalists as specimens of a new and unknown species. The destruction of sea-fishes may require many years, but there is no animal on earth large enough to be valuable as human food which

can long survive the attacks of a new unnatural enemy armed with the energy, the resources, and the intelligence of civilized man. Fortunately, the qualities which render him the most resistless of enemies also enable him to become a producer as well as a destroyer; and, while the fear of him and the dread of him is upon every beast of the earth and upon every fowl of the air and upon all the fishes of the sea—while they are all delivered into his hands, and are powerless to resist him—he alone of all animals is able to make good the destruction caused by his ravages, and to increase, by agriculture, by domestication, by selection and improvement, and by artificial propagation, the animals and plants which he destroys.

Can these influences be brought to bear upon marine animals? Can human intelligence and skill and power over Nature be so employed as to make quickly, by artificial means, that slight adjustment in the birth-rate of food-fishes which would have been brought about more slowly by natural agencies if man had long occupied his present rank among their enemies?

Looked at in this way, the proposition certainly does not seem to be impracticable; and, while human efforts in this field are of too recent a date to furnish positive evidence, I believe that I have shown that there is no *a priori* impossibility and no logical basis for a negative answer to the question. The results which have already been reached by the artificial propagation of certain sea-fishes, like the shad, which make periodical visits to fresh water, are extremely interesting, as they furnish indirect evidence which is very conclusive. They prove that human influence produces very prompt and decidedly advantageous results in the case of these fishes, and thus give us every reason to hope that equally valuable results will follow—a little more slowly, perhaps—from our efforts to increase the supply of more strictly marine species.

In the year 1880 the fisheries census and special investigations which were carried on under the direction of the United States Fish Commission proved that there had been a most rapid and alarming decline in the value of the shad-fisheries in the rivers and bays and sounds of our Atlantic coast, and that there was every reason to fear that in a few years the shad would be utterly exterminated. The adult shad is an oceanic fish, but each spring it enters one of the inlets or bays and makes its way up to the fresh-water streams to reproduce its kind. The supply of shad for the market is caught during this spring migration, when the fishes enter our inland waters plump and fat after their winter's feast upon the abundant supply of food which they find in the ocean. As they spend the greater part of each year gathering up and converting into the substance of their own bodies the innumerable minute marine organisms which would be of no value whatever to

man without their aid, and as their natural instincts impel them to bring to our very doors this great addition to our food-supply, their economic value is very great, as they put at our service a vast area of the surface of the globe which would otherwise be entirely beyond our control. The extinction of the shad would, therefore, be a national calamity.

In 1880 the fishermen believed, apparently with good reason, that the rapid decline was due to improper methods of fishing—to the erection of pounds and weirs along the shores of the salt bays and sounds, where the fishes were captured in great numbers long before they had reached their spawning-grounds. It was urged that, if these obstructions were removed, and all the shad were permitted to reach fresh water before they were captured, enough eggs would be deposited each year to keep up the supply, but that the destruction of such great numbers in salt water must necessarily result in extermination. This seemed to be good logic, but in the spring of the year 1888 more shad were caught in salt water than were caught altogether in the year 1880 in both fresh and salt water; and yet the shad-fisheries are now increasing in value from year to year, while in 1880 they were in danger of destruction.

To what is this change due? In 1880 the United States Fish Commission began systematically and upon a large scale the work of collecting the eggs from the bodies of the shad which were captured for the market in the nets of the fishermen. These eggs were artificially fertilized and hatched; the young fishes were kept for a few days in captivity in glass jars; they were then set at liberty in the fresh-water streams, and the waste of eggs was thus prevented. This work has been prosecuted steadily for eight years, and the results are briefly summarized in the following table:

YEARS.	Shad captured in salt or brackish water.	Shad captured in fresh water.	Total.	Percentage of increase over 1880.
1880.....	2,549,544	1,591,424	4,140,968	..
1885.....	3,267,497	1,906,434	5,172,931	25
1886.....	3,048,768	2,485,000	5,584,368	34
1887.....	3,813,744	2,901,661	6,715,405	62
1888.....	5,010,101	2,650,373	7,660,474	85

The money value of the excess in 1888 over the total catch in 1880 is more than $700,000. The conditions are now more unfavorable than ever to natural reproduction, and there can be no doubt that, if no shad had been produced by man since 1880, and if all the other conditions had been as they are, the fisheries would now be valueless. The mature shad which run the gantlet of all the pounds and traps in the lower waters, and finally reach the mouths

of the rivers, are excluded by dams and other obstructions from all the streams which are of most value as feeding-grounds for the young; and the area which is now available for spawning is restricted to the lower waters of the rivers, which are so assiduously swept by drift-nets and seines that each fish is surely captured soon after its arrival, and before it has had an opportunity to deposit its eggs. The number of eggs which are naturally deposited is now very small indeed, for, while the take upon the spawning-grounds has increased from 1,600,000 in 1880 to 2,600,000 in 1888, the take in salt water has increased from 2,500,000 to 5,000,000, and the shores of our bays and sounds are now so thoroughly lined with both nets and pounds that the number of shad which reach the spawning-grounds at all is proportionately much less than it was eight years ago, and more shad are now taken each year in salt water, where spawning is impossible, than were taken altogether in 1880. The fact that, in spite of all this, the value of the fisheries has increased eighty-five per cent, seems to prove that the shad is now entirely an artificial product, like the crops of grain which are harvested on our farms.

If any one doubts whether this result is due to man's efforts, we have more conclusive evidence. Previously to 1870 no shad were found in the Pacific Ocean or in any of its tributaries. Between 1870 and 1875 the United States Fish Commission introduced a few young shad into the Sacramento River. The number was very small, but the little fishes made their way down to the Pacific to feed and grow large and fat, and to return at last to the fresh water to reproduce their kind. Some of them came back to the same river, but others, following the warm Pacific current, wandered farther north into other rivers, until now the shad is in some places sufficiently abundant to furnish profitable fisheries, and it is distributed along more than three thousand miles of the Pacific coast of North America, and is still spreading northward in such a way as to indicate that it will in a few years be found in the rivers of Asia, so that the descendants of the shad of the Chesapeake Bay will increase the food-supply of China. If such noteworthy and valuable results follow the artificial culture of a fish which spends the greater part of its life in the ocean, and there obtains its food, is there any reason why man should not also make good his destruction of species which are more strictly marine?

The great increase in the shad-fisheries during the last eight years has been effected by the use of means which, while effective, are very crude and primitive as compared with those of modern agriculture, for example, and we must look for great improvements and a vastly greater return in the future. A farmer who did nothing more than to save and sow wild seeds which would

otherwise be lost on sterile ground or killed by frost or damp or eaten by birds and insects, would no doubt effect a slight increase in the food-supply, but his efforts would be very far behind the requirements of modern agriculture. His harvest would be as nothing compared with that of the farmer who sows improved seed; cultivates, protects, and nourishes his seedlings, and thus increases many hundred-fold the bounty of nature. Can similar improved methods be applied to the harvest of the sea? The Superintendant of the United States Fish Commission, Prof. Marshall McDonald, is now trying on a large scale experiments which will furnish an answer to this question, and the result will be eagerly looked forward to by those who are interested in pure science, as well as by those who value nothing except economic results. The young shad which are reared from the artificially fertilized eggs are usually turned out into the streams soon after they are born to shift for themselves. Many of them perish from accidents and the attacks of enemies, while others are forced to struggle for an insufficient supply of food. All horticulturists and breeders of domesticated animals know that the size and vigor and vitality of a plant or animal depend to a great degree upon its treatment during its infancy and youth, and that a stunted or injured infant seldom becomes a valuable adult plant or animal. Last spring about half a million young shad were placed soon after hatching in a large pond in Washington, and were carefully tended and fed and protected from enemies during the whole of the period which the young shad spends in fresh water. The young fishes prospered and grew rapidly, and nearly all of them were still alive when the time for migrating to the ocean came in the fall. The gates of the pond were then opened one morning, and all day long the silver stream of young shad poured out through them and started on the long journey down to the sea. All naturalists will look forward with the greatest interest to the time when these fishes return, bringing back with them to the fishermen of the Potomac the wealth of food which they have gathered in the ocean. In the mean time we may indulge the hope that the strong constitutions which they have acquired during their carefully nurtured youth will enable them to excel their less favored brothers, and that when they reach our market they will have some of the excellence of our improved garden products.

But this is not all. These shad were reared from selected eggs. The adults which enter our waters first in the spring are most valuable to the fishermen, since they are put upon the market at a time when fresh fish are scarce and high priced. Our experience with garden vegetables justifies the expectation that the eggs of early shad shall themselves give birth to early shad. Now, all

the young fishes which were put into the Fish Commission pond were hatched from eggs taken from the earliest shad of the season, and, if this process of selection be pursued for a few years, we may feel confident that the Potomac River will soon abound in shad of extra quality at the time when fine shad are hardest to get and most valuable.

RAILWAY MALADJUSTMENTS.

By BENJAMIN REECE.

IT is a remarkable fact that in social and industrial concerns men never dream of restoring an equilibrium by withdrawing the forces which disturb it, but they invariably demand the exertion of new and opposite forces to neutralize the effect of those in operation which could more easily be removed. When the moving locomotive is to be brought to a stand, the engine-man shuts off the steam and applies the brakes; but the practical statesman, and indeed many economic students, never dream of this simple method in dealing with social problems; they almost always insist on bringing out another locomotive of equal weight and power to run counter to the one in motion and thereby neutralize its energy, and the forces generated in the two locomotives are thus lost in preserving an equilibrium which could have been more readily secured by closing the throttle-valve of the one which it was designed to stop. The railroad manager making such use of his motive power would be deemed insane, yet in our industrial concerns a similar application of social energy is declared to be the only practical method, and those who decry its folly are contemptuously termed impracticals.

The space devoted by the leading periodicals to the discussion and investigation of the causes which underlie the disordered and incongruous development of our railways, as well as the numerous remedies proposed, fully attest their state of utter instability, which, if not corrected, may ultimately lead to practical confiscation by means of legislation, or their purchase and control by Government. In whatever light we view the social and industrial relations of the railroads, we are confronted by that state of chaotic confusion which must ever result from a persistent transgression of natural law.

Yet, while railroad managers are pleading to be preserved by legislation from their reciprocal aggressions, while the railroads and the public are asking for laws to protect them from their mutual hostilities, while railroad companies and employés have vainly sought an equitable adjustment of their differences, and are each looking to legislation to define their rights and limit

their obligations, it is worthy of all attention that in the physical and mechanical phases of its development the railroad is a marvel of orderly design, a monument of human energy, organization, and skill, to the perfection of which every branch of scientific research has contributed and revealed to man the proper adaptation of means to ends.

In a recent article* it was pointed out that to increase the specific gravity of water would at once disturb its relations to every other form of matter, and that the equilibrium so destroyed could only be restored by a return to natural adjustments. Do not the disordered industrial relations of our railroads present a striking parallel?—for, with regard to their social and economic relations, viz., to the investors who own them, to the employés who operate them, and to the public who employ them, their adjustments are non-adapted, and have thus far proved non-adaptable; for innumerable laws, intended to be remedial, have only served to increase the disorder and perplexity. Is it not time that we ceased our vain attempts to neutralize by balancing unmeasured, unweighed, and complicated forces, and turn our attention to the discovery of the original sources of disturbance, so that by shutting off the steam and applying the brakes the equilibrium of adjustments will be reinstated?

In the examination of the many evils which it is sought to remedy, I will refer to articles in recent publications, contributed by gentlemen whose experience and intimate knowledge of details connected with railroad management enable them to speak with authority, and I can not but conclude that an analysis will show all the disturbances enumerated to have their origin in two groups of stimulating laws, and in their repeal will be found the only true and permanent remedy.

"The Political Control of Railways"† is a general argument against legislation which prescribes and enforces regulations for the administration of railroad proprerties. The author calls for the repeal of the Interstate Commerce Bill, and of adverse laws enacted by the States; but such enactments had their origin in an effort to restore the equilibrium between the railroads and the public, and they stand as the reactions of, and not as the active causes of, the original disorder. It is true the repeal of these laws might restore harmony between the railroads, but only by a further unbalancing of the relations between the railroad companies and the public. The argument is substantially this: that having built roads without regard to commercial necessities or demands, investors should be permitted to unite in pools, etc., to secure the

* "Law as a Disturber of Social Order," "Popular Science Monthly," March, 1889, p. 632.

† Appleton Morgan, "Popular Science Monthly," February, 1889.

maintenance of profitable rates, and the author insists that legislation aiming to prevent such unions or agreements or regulating rates is in the nature of confiscation. This seems plausible, for it is only a half-statement of the case; as the Western granger, who has granted a free right of way and voted aid for the construction of competing lines of railways, views such alliances as treachery and dishonesty, to be prevented and punished by legal penalties.

The author of "Legislative Injustice to Railways"* condemns attempts at State regulation, which from the very nature of things must more or less directly interfere with interstate commerce; but, upon the whole, he is disposed to look upon the Interstate Commerce Bill as a step in the right direction, and would only recommend certain modifications of the anti-pooling and the long and short haul clauses. But in the main this writer asks for legislation aimed directly at the inherent dishonesty of railroad management; viz., he wants laws compelling directors to publish truthful reports, and asks the appointment of public accountants to examine and attest all reports for publication. He asks a law making it incumbent upon railroads to elect at least one thoroughly trained and honest director, specially educated for the purpose. He also insists on legislation "to regulate the methods of construction companies," which, he says, "are probably doing more to demoralize the railroad system than any other factor," and he broadly intimates that these companies are nothing but organized schemes for the enrichment of thrifty directors at the expense of the stockholders.

"Bribery in Railway Elections"† is an argument to show that the many evils complained of are the result of systematic bribery employed in the election of the directors who control the management of railway properties. The writer asserts that the practice is neither business-like nor moral, "and requires some weapon more potent than argument," hence he demands enactments prescribing heavy penalties. But surely bribery within the railway company can not be the cause of demoralization, for it is but a symptom of a diseased organism, and proves the evil to rest in the constitution of the railway corporation itself, which is the creature of statute law. What could better indicate the operation of foreign and abnormal forces than this acknowledgment that our railroads are controlled by forces neither "business-like nor moral"? Is it not evident that such an organism is of artificial origin, and is unfitted to survive unless its business and moral qualities are developed on a plane with the importance and far-reaching influences of the properties controlled?

* Henry Clews, "North American Review," March, 1889.

† Isaac L. Rice, "The Forum," March, 1889.

In "The Prevention of Railroad Strikes,"* as the title indicates, the author confines himself to the want of harmony existing between railroad companies and their employés, and suggests a plan for improving their relations by bringing the officials of the roads into closer personal contact with the men.

An examination of the evils, as above given from various sources, proves them to be symptoms of a chronic disease, at once suggesting a complication of disorders arising from two forms of original stimulation, which, although more or less reciprocal in their operations, are susceptible of a tolerably distinct line of division: viz., (1) legislative stimulation of railway construction; (2) legislation tending to push capital into unnatural combinations. These two groups of laws give rise to evils independent of each other, although when coexisting they interact, and not unfrequently the one furnishes the means while the other affords the occasion for dishonesty, as the construction companies heretofore alluded to make plain; e. g., while our loose laws, encouraging the construction of new railroads, have afforded the opportunity or occasion for directors to insidiously absorb the profits of stockholders by the extension of systems, the laws which have united "unbusiness-like and immoral forces" for the control of railway properties have placed in the hands of designing men the tools and means of doing so dishonestly.

In this present article let us confine the inquiry to the evils arising from laws intended to induce the speedy construction of railroads, and we will leave to a future number the examination of those evils which have developed within the railway corporation itself, of which railroad wrecking, false reports, bribery in railway election, and railroad strikes are familiar phases.

The splendid opportunities which the railroad afforded for the development of a country's resources were very quickly recognized by society at large, and, being impatient of the reasonable caution exercised by capital before embarking into vast and costly enterprises, the people through their Legislatures enacted laws especially calculated to promote and hasten the construction of railroads, never imagining that any evils could arise therefrom. The Western and central States particularly enacted laws providing for State subsidies and local aid, while the General Government joined the States in the surrender of the public lands to railroads. Nearly all the States passed general railroad laws substantially granting railway charters to any one who followed the legal forms in making application for them. These various laws have all contributed to destroy the equilibrium between the normal wants of a developing commerce and the natural development of railway systems within prudential limits to meet the growing demand,

* Charles Francis Adams, "Scribner's Monthly," April, 1889.

and much of the present demoralization is due to the rash, impetuous folly of those who hoped to enjoy the pleasures of stimulated activity and still escape the reacting evils.

When legislative inducements were made to investors for the construction of new railroads, capitalists were pleased to be relieved of ordinary prudence in making their investments, and upon the strength of such legislation continued to build railroads in excess of commercial wants, expecting to so adjust the traffic rates as to insure to them good profits; but this was never the purpose of the shippers or of the legislators who represented them, for, by the construction of numerous lines, they expected to arouse a spirit of competition among the railroads which would lead to cut rates and reduced cost of service. Thus the original laws which stimulated the organization and construction of railroads polarized the interests of the investors and the shippers, and made mutually repellent forces which should have mutually attracted. Each was deluded by false hopes, for neither considered the rights or interests of the other, and all subsequent legislation which has aimed to preserve the benefits of unwise and premature railroad construction to the public has shifted all the evils and consequent losses upon the railroad companies, while the efforts of railway companies to avoid all competition, by a division of revenues would throw the entire burden of supporting useless roads upon the public; and it is this unbalanced condition of affairs which has led to aggressions upon the part of railroads, adverse verdicts by juries, and hostile legislation by the States, all of which are in the nature of reactions due to the disturbance caused by the original laws.

For example, between the cities of Toledo and Detroit there are two lines of railway passing through the same towns, and for the greater part of the distance running side by side, their rights of way abutting. These two roads, being branches of the Lake Shore and Canada Southern respectively, were originally independent and competing lines, but, as one could have carried the business brought to the two, it is evident that the conflict was only a question of the survival of the fittest. In this as in most other cases the new road ultimately fell into the hands of those who owned the original line, and, though under different managers, are operated under one controlling policy; rates were equalized, train schedules harmonized, and the business which with the small additional cost of a second track could be more cheaply performed by one line must now earn the fixed charges and pay dividends on the stock certificates of two, all of which extra expense must be paid by the people. So long as the roads were in competition, they were a source of loss to the owners; when they harmonized their differences, they became a burden to the public; and the class of

legislation which encouraged the construction of the second line, under the false pretext to the public that it would serve as a competing route, has really imposed upon the people the expense of supporting two railroads when their interests could be as well or better served by the support of one. The West Shore, Nickel Plate, and other lines were practically built for the purpose of sale to the old roads which they paralleled and threatened with ruinous competition, and, as in the first instance named, the people living along those lines are now compelled to pay for the maintenance of two railroads, while for all practical purposes they derive benefits from only one. Is it not evident that the construction of railroads in excess of commercial needs must entail a loss upon the investors or an additional cost to shippers; and so long as this unbalanced state exists the railroad companies can only be saved from losses by pooling with, purchasing, or gaining control of competing lines, and thereby throw the cost upon the people? Or if the latter, through legislation, the verdicts of their juries, and interpretations of their courts, can thwart such combinations, purchase, or control, then the full force of vicious legislation will be shifted to the railroads, and as investments those properties will be ruined.

The rights and obligations of railway companies and the public meet and harmonize at the point where, the facilities provided being ample for the business, the amount of traffic is sufficient to make a low cost of service remunerative to the investors; but this desideratum can not be attained by legislating to preserve railroad properties by restricting competition and legalizing pools, nor by anti-pooling clauses to foster competition; it will only come through the repeal of the disturbing laws which by stimulating the construction of railroads polarized interests which natural adjustments made identical; but normal adjustments are impossible so long as laws exist which offer advantages to the investor other than the natural and legitimate profits of the investment.

Let general railroad laws be repealed, and, before the legislative authority to exercise the right of eminent domain is extended to a railway company, let the public necessity for the construction of a railroad be fairly shown and affirmatively proved as required by the common law.

Is the present demoralization to be wondered at when, in most of the States, charters granted under general laws are deemed as *prima facie* evidence of the public necessity, although railroads so chartered may be projected side by side with those having facilities not half employed?

Not uncommonly it is claimed that the railroads have made the country what it is, but is it not equally true that the country has made its railroads what they are? The two statements com-

plement each other, and afford further proof that a stable adjustment is only possible when the development of a country's commerce and its means of transport and communication advance together.

The State of Iowa early passed sundry laws very favorable to the construction of railroads, and, as a consequence, induced the premature development of several systems. For convenience of illustration, let us watch the early settlers of Iowa distribute themselves along three lines of railroad when they could have been better accommodated at less cost for highways, schools, churches, policing, and the administration of township and county affairs along the line of one; but in addition to these incidental burdens they found themselves compelled to pay high rates for railway service in order to pay the fixed charges and dividends on the stock of three railroads doing the business of one. If the legislators had been endowed with the common sense of the locomotive-driver, they would have closed the throttle-valve and put on the brakes; but, instead of doing this, they allowed the disturbing laws to remain in force, and prescribed legal rates to be charged for railway services, hoping thereby to retain the benefits and still escape the evils of premature railroad extension, and from that day to this Iowa has vainly sought a satisfactory solution of the problem.

The evils to be corrected were those due to the premature or unnecessary construction of railroads: this could only be accomplished by deterring such construction; and in so far as the laws succeeded in so doing, the people were relieved of the evils but lost the advantages arising from the operations of the original law, and, in so far as the remedial laws failed to deter further construction, the evils as well as the supposed benefits of the original law remained in force.

As might be expected, the two classes of laws—the one stimulating direct, the other repressing railroad extensions by impairing their value as investments—did not operate to restore a stable equilibrium; for the adverse legislation was not aimed directly against premature and unnecessary construction, but it simply made the conditions of operating railroads more onerous.

Hence the influence of the two laws may be likened to a see-saw, and in their operations they have caused abrupt changes and violent oscillations. The first effect of adverse legislation tended to stop further building; but when populative increase caused the legal tariff rates to become remunerative to the railroads, the deterring laws became inoperative, the stimulating enactments once more hastened a development far in advance of the natural wants, and the pressure of adverse laws was again experienced; and so these spasmodic fluctuations have taken the place of the

steady, rhythmic development which results from the operation of natural laws and is ever indicative of genuine progress and stability.

The pernicious influence of such conflicting legislation has led capital to alternate its moods between the extremes of inexcusable recklessness and unwarranted timidity; whereas the repeal of laws encouraging construction would withdraw the incentive of the reckless, while a similar repeal of laws discouraging construction would quiet the fears of the timid, and a healthy growth and a stable development would result.

Laws which have led to the construction of parallel lines of railway have diverted capital from the improvement of the country's highways; and even in Illinois and adjoining States, during certain seasons of the year, a ton of freight can be shipped a thousand miles to the seaboard at less cost than it can be hauled a distance of ten miles to market; yet, in spite of this grotesque condition, laws encouraging further railroad extensions still deface their statute-books.

The Interstate Commerce Bill aims to correct the evil, but it will fail, for it does not touch the cause. It attempts to cure evils which have come from unnecessary and premature construction by regulating the operation of railroads. Its direct and immediate effects appear to be good, for men do not concern themselves with the necessary reactions which are the true adjustments by which any laws or systems of laws must be judged.

Here is our railroad system in a state of utter demoralization and confusion, and yet the "Railway Age" of April 12th presents a table in detail showing that six hundred and sixty-six new lines are in contemplation, with an aggregated mileage of over fifty-three thousand miles, of which nearly fifteen thousand miles are under construction or contract, nearly ten thousand miles are surveyed, and twenty-nine thousand miles incorporated only. Does this not suggest the probable direction which the reaction to the Interstate Commerce Bill will take, unless stimulating laws are repealed, viz., a separation of the men who build the railroads on speculation under the one class of laws and the *bona fide* investors who will be compelled to purchase and operate them under the other class of laws? Can any one imagine the bewildering complications which the new adjustment threatens?

The Interstate Commerce Bill gives fair warning to investors that, if they avail themselves of laws which encourage the construction of railroads, they must suffer the consequences of their rashness, for they will be permitted neither to combine in pools nor discriminate in rates. This would be fair and logical if the parties constructing railroads were also the ones who operate them; but, unfortunately, our laws are so devised as to give aid and en-

couragement to persons who construct railroads without regard to public wants for speculation merely, and then so manipulate them as to compel old companies to purchase and operate the new lines in order to save losses on the old, which can not be done without additional cost to the people.

If we would restore harmonious relations between the railroads, we must repeal the laws which are more favorable to those who build than to those who operate them; and by such repeal the construction of railroads for purposes of blackmail and speculation will be made impossible, and the occupation of dishonest construction companies will be gone.

Is it not evident that to prevent ruinous competition and adverse legislation of which the railroads complain, and to avoid the discrimination, pools, and combines of which the public complain, we must close the throttle-valve and apply the brakes, and, by repealing, arrest the operation of those laws which have led to undue and premature railway construction; and, as population increases, existing railway systems will be more fully employed, and new systems will be extended only on their merits? Under such conditions disturbances will become less and less marked, pulsations less and less severe, and a stable equilibrium will be speedily restored.

An analysis of the testimony presented to the United States Senate Committee on Interstate Commerce, which entered upon its investigation after the above article was in type, fully confirms the position assumed. Mr. Fink stated to the committee that there were too many roads, and that, if the Grand Trunk and a half-dozen other lines did not exist, the public would be as well served as now. It was generally acknowledged that the law was not fully observed, and Mr. Depew did not hesitate to state that it never would be unless pools were legalized.

With few exceptions the railroad managers asked for the abrogation or modification of the anti-pooling and long and short haul clauses, which led Mr. Herrick, of the New York Produce Exchange, to remark, that "it seemed as if the railroads wanted to abrogate just what the public demanded should be enforced." Mr. Depew admitted that the law has prevented the building of useless roads, and that the condition of the railroads had improved, but not so much as would have been the case had they been permitted to pool. He said, "The law has proved beneficent to the public at the expense of the railroads"; but with legalized pools the converse might be stated, for they would improve the position of the railroads at the expense of the public.

Mr. John D. Kenna, ex-railroad commissioner and attorney for the Produce Exchange, insisted that the Interstate Commerce

Act extended to the roads all the advantages which could be legitimately derived from a pool; and he very justly observed that, when recklessness had reached its length, the railroad presidents and bankers ordered their employés to obey the law and *stop building useless railroads.*

Mr. John Newell, President of the Lake Shore, declared that "for fifteen years they had fruitlessly sought a solution of the difficulty"; the cause of failure is not obscure, for railway pools, like legislation, sought to annul the unfavorable conditions induced by over-construction; but moderating the evil effects simply resulted in the unchecked persistency of the cause; hence new roads were built, expecting to enjoy the artificial profits derived through combination, and, if denied a connection with the pool, the new roads entered the lists as freebooters and disturbers until their claims were allowed.

Since the Interstate Commerce Law is neither fully respected nor enforced, what its effect will be is undetermined; but as it aims to lessen the evils due to excessive railroad-building, it will tend to increase the energy of the original disturbing cause, and will probably result in specializing the speculative constructor as distinct from the operator of railroad properties; and as the impinging forces are intermittent in operation, it is at once suggestive of the attempt to balance an egg upon its end. Railroad managers would scale up rates by combination, the people would scale them down by competition; in either case the gain of the one is predicated upon the loss of the other.

In the normal adjustment of means to ends, of supply to natural demand, no such conflict appears, for the public could be better served at lower cost, while the railroads could secure fair profits from a larger traffic at lower rates.

The strength of this position does not rest upon the fact that "existing railroads have all they want," but on what Senator Blair failed to comprehend, that the public are already provided with more railroads than the traffic at reasonable rates can sustain; hence no possible legislation can be invoked which can prevent either a loss to the railroads or added burdens upon the people.

THE existence of evidences of the Glacial period in the Altai Mountains was doubted by B. Van Cotta, who failed to find them. But Mr. E. Michaelis, in 1870, observed "undoubted traces of a mighty spreading of ancient glaciers" in the southern part of the range, where there are now some large glaciers and snow-covered ridges. Among them are deposits of bowlders, of various rocks, confusedly mingled, the smaller ones well rounded and the larger ones more angular, while the intervals between the stones are crammed with clay and sand. The relation of these deposits to the neighboring defiles is in most cases incomprehensible.

MUSCLE AND MIND.

By FRANCES EMILY WHITE, M. D.

THE fundamental characteristic of the animal world, as distinguished from the vegetable world, lies in its different relations to the energies of matter. Every animal is a mechanism for the liberation of energy previously stored up, in great part, in the tissues of plants which serve as food for these higher forms of life; and the quantity and kinds of energy liberated in any animal are determined mainly by the degree of development of the muscular and nervous systems, the other tissues and organs of the body being subservient to these two, which have been well styled the master tissues.

But the animal differs from the plant, not only in the power of liberating energy, and thus acting on the outside world; it is also differently affected by the outside world, the energies of which play upon its living tissues as the wind upon the strings of an Æolian harp; and the sensitive organism thrills under these influences with responsive sensations of greater or less diversity and intensity according to the variety and grade of development of its sensitive organs.

The muscular and the nervous tissues, upon which depend the distinctively animal functions of sensation and spontaneous movement, develop together, and their relations, both anatomical and physiological, are of the most intimate character.

Rudimentary nerve-threads are found in the *Hydra;* first recognized by Klinenberg, they were regarded by him as partly nervous and partly muscular; and the most primitive fibers positively identified as true nerves serve as pathways of communication from the sensitive surface to the rudimentary nerve-centers, and from these centers to the equally rudimentary muscles of the simple animals to which they belong. In short, the primitive nervous system is merely an immature apparatus for the production of sensations and the excitation of movements of the kind called "reflex," since they are excited by a stimulus transmitted from the surface of the body to the nerve-centers and thence reflected, as it were, to the muscles;* and a large proportion of the nerve-bundles which, with the centers, make up the nervous system of man, consists of fibers of communication between the muscles of the trunk and limbs and their stimulating centers in

* The term "reflex" is a misnomer, as the action of the nerve-center is not the mere reflection of an impulse received from the periphery. The word is used to indicate that the exciting cause of activity of the center arises outside itself, and not, as in so-called "automatic" action, within itself.

the brain; and since no muscle normally contracts except under the stimulus of a nervous impulse transmitted through a nerve-fiber from the central nervous system, my first thesis will be at once admitted, viz., that *exercise of muscles necessarily involves exercise of their associated regions in the central nervous system, and that voluntary movements at least require the activity of certain areas of the brain.*

It is admitted that the evolution of mind in the animal series and that of the bodily organs have kept pace with each other. The hemispheres of the brain increase in size and in complexity in the ascending zoölogical scale, the animal becoming mentalized in a direct ratio to the development of this part of the brain, which in man forms by far its largest subdivision. The doctrine, first definitely formulated by Fritsch and Hitzig, that the cortex of the brain contains special centers which govern definite groups of muscles,* is most significant in connection with this subject. They and their followers divide the brain cortex into two principal regions—one of sensory areas, which lie in the hinder part of the brain, and another of motor areas, which lie anteriorly; i. e., into a region engaged in receiving from the surface organs (the skin, the eye, etc.) impressions which excite the various sensations, and a region concerned in exciting and co-ordinating the movements of the body. The motor centers thus far definitely located are those which control the muscles of the face, arm, leg, and trunk. They lie on each side of one of the fissures of the brain,† in the order named from below upward—an arrangement which led Dr. Lauder-Brunton to suggest that it had occurred in accordance with the progressive evolution of the faculties, premising that the uppermost in position were the latest to be acquired and the highest functionally. Thus animals low in the scale seize their food with the mouth; the center for the face-muscles was therefore earliest in order of development, as it is lowest in situation. Animals of a somewhat higher grade grasp their food with the anterior limbs—the next higher centers being those devoted to the arm-movements. Animals still further advanced in development have the power of running after their prey, using the posterior to assist the anterior limbs in accordance with the higher level of the centers concerned. Later still, the trunk muscles come to the assistance of the arms and legs in the all-important work of securing food, the first necessity. Coincident with these observations is the fact that the higher the center the more it requires education in the human being. The new-born infant has control of the muscles of the mouth to

* Known as the doctrine of localization.

† The fissure of Rolando, anterior to the fissure of Sylvius which separates the motor from the sensory areas.

the extent of appropriating the food placed at its lips; yet, for the effective use of the arms and legs, months of training are necessary; while definite movements of the trunk, as in dancing, bowing, etc., are acquired much later in life. It is also a most significant fact that the center for the control of the various and complex movements concerned in speech is limited to the left side of the brain in *right-handed persons*—a few cases having been recorded in which disease of the corresponding locality on the right side of the brain has been followed by loss of speech in the *left-handed* *—implying that the more frequent and intelligent use of the muscles of the right hand and arm has had some connection with the development of the faculty of speech. This is corroborated by the fact that, among the lower animals, there is little if any difference in the use of the anterior limbs, as there is also absence of the faculty of speech—a factor of the highest importance in mental development.

Although the doctrine of localization has distinguished opponents, Prof. Goltz denying that either sensations or movements have any special centers in the brain, and the late George Henry Lewes opposing the idea to the extent of saying, "It is the whole man who feels and thinks," nevertheless the doctrine is gaining ground. At least two cases have been recorded of otherwise normal individuals in whom a congenital absence of the left hand and a part of the arm was accompanied by a rudimentary condition of the corresponding convolution on the right side of the brain, showing that the building up of these motor areas in the brain is largely dependent on muscular exercise during the period of growth. That the maintenance of their nutrition in the adult is also to some extent dependent on muscular exercise is made probable by the fact that wasting of the corresponding convolution has been found in a few instances after amputation of a limb. Removal of the brain, slice by slice, in the lower animals is followed by a corresponding reduction both of intelligence and of power of voluntary movements which disappear together in about an equal degree; and every observer knows that in many cases of brain disease intelligence and the power of voluntary movement alike suffer in proportion to the extent of degradation of brain substance. There is also no more conspicuous feature of idiocy than its accompanying feeble, irregular, and uncoördinated movements. Just what relations exist between the motor areas of the brain and general intelligence is not a matter for dogmatic assertion; but that these centers form a part of the intellectual machinery is undoubted, and the facts cited, without reference to theories, may be regarded as proving my second thesis, viz., that *the systematic and regular use of the voluntary muscles of the body*

* Küssmaul.

must have an important influence on the development of the brain, and hence also of the mind of which the brain is the organ.

Whatever differences of opinion may exist as to certain minor points in the physiology of the brain, all agree that it is organized on the same general plan as are the lower parts of the nervous system, and as are the entire nervous systems of those simple animals whose functions consist in feeble sensations which arouse equally feeble movements; and as there are no abrupt transitions either in the animal series or in individual development, so in the nervous system of man there is no abrupt introduction of mental conditions of a kind totally different from those which prevail at a lower plane of animal life, but rather the foundations of all mental processes are to be found in simple reflex actions. The mental building material is, therefore, derived from movements as well as from sensations; and a sensation and its associated movement may be said to constitute *the psychical unit of the whole mental life*, as a sensory and motor nerve with their connecting center constitute the structural unit of the entire nervous system.

It is argued by Prof. Bain* that it is by the experience of muscular exertion that we obtain our first real knowledge of the external world—a "not-me" as opposed to the "me" of passive sensation. Mr. Herbert Spencer also describes our fundamental conception of *matter* as of something which offers resistance.† The different degrees of resistance met with from the "not-me" calling out different degrees of muscular effort, there arises a sense of discrimination which is the beginning of knowledge.

The duration of a muscular act also leaves its impression as a distinct element of consciousness; and the continuance of the mental state which accompanies this duration becomes a measure of *time*, the idea of which is thus incorporated in our mental make-up from the very dawn of consciousness.

The origin of the perception of *space* is similarly traced, in part at least, to movements; especially the idea of linear extension, which is greater or less in any given case according to the degree of contraction involved in moving the limbs through space, taken in connection with the time occupied. It is, then, largely by these fundamental modes of what may be termed muscular discrimination that we acquire our ideas of matter, of time and of space—the classic triad of "innate ideas" of the intuitionists. These supposed innate ideas being, however, susceptible of a psycho-physical explanation, we are bound by the law of parsimony to accept it.‡

* See "The Senses and the Intellect," by Prof. Alexander Bain, M. A.

† See "First Principles."

‡ The view advocated by Prof. W. James (see "Mind," 1887), that all sensations have

It thus appears that the brain has a twofold connection with the muscular machinery of the body; that it not only supplies the stimulus required for the production of voluntary movements, necessitating a corresponding activity on its own part, but that it is stimulated in turn by the active muscles; since every contraction is a separate occasion for the return of responsive impulses to the brain, by means of which the corresponding centers there are informed of the degree of energy put forth, and the extent of the resulting movement. Voluntary movements are thus associated with three distinct kinds of consciousness: 1. That which accompanies the outgoing impulse from the brain—the so-called "sensation of innervation."* 2. That excited by contraction of muscles through impulses arising within the muscle itself and thence transmitted to the brain—the true muscular sensation in which the muscle acts the part of a special sense-organ. 3. That produced by the resulting movement, also due to impulses sent to the brain—perhaps from the surfaces of the bones as they move against each other at the joints, or from the stretched and compressed tissues, especially the tendons in which many "Pacinian corpuscles" are found.

The brain is thus infused with a knowledge of the work done by the muscles, and hence of the external world of matter upon which the body acts by means of its muscles. These *muscular tuitions*—so-called intuitions—become permanent constituents of the mental life; and my third thesis is to the effect that *the muscles play a rôle in the development of mind similar to that which belongs to the other special sense-organs—the eye, the ear, etc.*

The dependence of intellect upon sensation was recognized by Aristotle in his famous dictum, "Nothing in the intellect not first in the senses";† and whatever the differences of view which divide the schools of psychology or individual psychologists as to the origin of our ideas of matter, time, and space, and whatever the real nature of the so-called "muscle-sense," all agree that the special sense-organs are the chief avenues of approach to the

an underived spatial element, though opposed to that of the exclusively muscular origin of the space idea, does not conflict with the general scope of my argument, since, as will appear later, the more important special sense-organs involve a muscular element.

* Not a true sensation, since it starts from the center. These sensations are described by Prof. Meynert as dependent on the memory of originally reflex movements. See "Psychiatry," by Theodor Meynert, M. D.

† Said by Schwegler to be falsely attributed to Aristotle; the following citations, however, from Grote's account of the psychology of Aristotle show that this aphorism is in harmony with his philosophy: "Without the visible phantasm of objects seen and touched, or the audible phantasm of words heard and remembered, the '*nous*' [intellect] in human beings would be a nullity."—"The fundamenta of intellect are sense and hearing." Many other excerpts of similar purport might be given.

brain, and that the sensations excited through these organs constitute the raw material of the mental life—touch, hearing and sight being recognized as *par excellence* intellectual senses. Now, it is a most significant fact, from the point of view of my third thesis, that the activities of these three senses in particular involve muscular co-operation as an essential accessory; and the profound relations which exist between many of the mental processes and muscular action are at least adumbrated in certain experimental observations by Wundt upon the eye. He has shown, for example, that vertical distances appear greater than equal horizontal distances in the proportion of 4·8 to 4, and that the same proportion exists between the muscular forces which move the eye vertically and those which move it horizontally; that the minimum of movement of the eye capable of exciting consciousness of contraction and the smallest perceptible distance are in exact agreement, both answering to an angle of one sixtieth of a degree; that we are able to distinguish a difference in length of two lines if it amount to one fiftieth of the entire length of the shorter one—the difference in movement of the eyes in this case being also one fiftieth of their entire linear movement.*

These relations can not be mere coincidences. Ideas of the size and distance of objects are also attributable in part to the degree of muscular action involved; for the nearer an object to the eye, the greater the muscular exertion required in converging the axes of the balls upon the object, and the greater the tax upon the muscles of accommodation; and it is not the visual sensation alone which gives the idea of distance, although the degree of distinctness, no doubt, has a marked influence, but the muscular sensations excited by the movements of accommodation and convergence must also contribute to the result. A mere allusion to the immense importance of visual perceptions in our mental furnishings will sufficiently indicate the bearings of these facts on the relations of muscular activity to mental activity and growth. To the significance of the muscles as organs of the muscular sense must then be added that which is due to the existence of a muscular element in other sense-organs.

Since movements, no less than sensations, play a conspicuous part in the acquisition of knowledge of the external world, it follows that ideas are a revival of ideal movements as well as of ideal sensations. My fourth thesis is, therefore, that *ideas have no special separate centers in the brain, but result from the excitation of those areas which have taken part in the original acquisition of ideas, viz., the sensory and motor centers.* These two kinds of centers, with the inhibitory centers and numerous connecting

* See "German Psychology of To-day," Ribot.

fibers, make up the convolutions of the brain and constitute the physical basis of the mental life.*

The voluntary or spontaneous excitation of ideas is thus to be attributed to the activity of the psycho-motor centers, while the inhibitory centers, since they play an important part in attention and concentration of thought, are the seat of the higher faculties; and intellectual power probably bears a direct ratio to the development of these centers. By observations and experiments similar to those employed in localizing the sensory and motor areas, the inhibitory centers have been localized in the frontal lobes of the brain. The development of these lobes, as compared with other parts of the brain, is conspicuous in man; as a rule, also, great intellectual power is associated with great frontal development.†

The biological doctrine that automatism is a property of protoplasm supports the theory of the originally spontaneous character of the so-called voluntary movements, leading up to the view that volition is an underived quality of mind; but it is a biological fact that muscles and nerves appear on the stage of animal life together in the form of a reflex apparatus, and that the primordial movements executed by these specialized forms of protoplasm are reflex; my fifth thesis is, therefore, that *the germs of volition are to be found in movements; that volition, so far from providing an original stimulus to the muscular activities, has itself grown out of these activities—the voluntary movements developing secondarily from reflex ones.*

Movements in themselves excite agreeable sensations which prompt to repetition; such as prove injurious, however, become a source of pain which tends to their suppression—that is, to inhibition; volition, therefore, develops under the stimulus of pleasure combined with the repressive influence of pain, both of which result from the action of muscles. The will is thus disciplined and directed to such activities as are useful to the organism.

Prof. Meynert describes volitional impulses as due to the [revived] perception or memory of sensations of innervation. By means of association these memories acquire sufficient intensity themselves to excite movements which thus starting from the brain appear to be spontaneous; their character will, however, depend on what has been previously registered in the motor centers.‡ Although the brain-centers concerned in the exercise of voluntary restraint (the inhibitory centers), primarily stimulated to activity by the pain resulting from injurious movements, do not

* "Thought consists of a certain elaboration of sensory and motor presentations, and has no content apart from them." Article "Psychology," "Encyclopædia Britannica," Mr. James Ward.

† See "Functions of the Brain," by David Ferrier, M D., F. R. S. ‡ *Op. cit.*

expend their influence directly upon muscles, they may, nevertheless, be regarded as a part of the motor machinery, since they act on other centers which are motor; and, by the associated action of these two kinds of centers, the will gradually acquires a real though limited control over the voluntary muscles.

Volition, whatever its origin, involves a state of excitation of the brain and stimulation of body and mind. Opposition only serves to increase its energy (as the load in "the nerve-muscle preparation" * augments the force of the contraction), and under excitement intellectual as well as muscular work is more easily done. Emotional excitement, if not of too absorbing a nature, promotes intellectual activity, but the latter is itself accompanied by a peculiar exaltation of feeling which is a source of the keenest psychical satisfaction.

Stimulation, then, either sensory or volitional, is a necessary antecedent of activity—in common parlance, its cause. Prof. Bain advocates the idea that stimulation is the sole cause of pleasure, the nutritive functions by keeping up the vital energy enabling stimulation to be carried to certain lengths before degenerating into pain. If we fall short of the pain limit, we fail of the satisfactions which flow from the conscious expenditure of energy to the full degree of which the organism is capable. If we exceed this limit, we pay the penalty of physical degeneracy and resulting mental decrepitude with the accompanying falling off of activity, and hence of pleasure. Degeneration also follows from disuse—that is, the neglect of stimulation, and consequent inaction.

Sir William Hamilton, following Aristotle, defines pleasure as "the reflex of the spontaneous and unimpeded exertion of power of whose energy we are conscious." But exercise of power occurs as a result of stimulation. The larger statement of Prof. Bain, therefore, includes that of Hamilton; and, since the spontaneous exertion of power with the accompanying state of consciousness depends on excitation of motor centers, both these statements are involved in my sixth thesis, viz., that *movements are the primary source of pleasure and pain which, in the experience school of psychology, are recognized as the basis of the entire mental life.*

Mr. James Ward † regards the reflex movements immediately expressive of pleasure and pain as primordial, the voluntary movements being elaborated out of these. But movements occur presumably below the plane of consciousness—e. g., in vegetable protoplasm. We may therefore conclude that, in the developing animal series, the lowest members of which are indistinguishable

* The calf-muscle, with its nerves, taken from the leg of a frog. Within certain limits, the heavier the weight attached to the muscle the more powerfully it contracts when the nerve is stimulated.

† *Loc. cit.*

from plants, pleasure and pain gradually arose out of movements, thus leading to the development of volition.

Lucretius says:* "It is delightful to stand on the sea-shore in a high wind and watch the dangers of those who are on the deep; it is equally pleasant to behold from an elevated station a battle raging in the plains below, because it is naturally agreeable to witness those misfortunes from which yourself are free; but far more pleasant still is it to occupy wisdom's heights, and from thence to look down on others groping and wandering in search of the true light."† Although the want of sympathetic feeling shown in this poetic flight is shocking to the altruism of the nineteenth century, the idea is nevertheless in entire harmony with Hamilton's definition of pleasure, since consciousness of power naturally belongs to a position of superiority; and the feeling here disclosed undoubtedly constitutes an important element in human satisfactions. It is not always necessary that superiority should be demonstrated in order to the securing of its legitimate effects; a powerful mastiff scorns to use his strength against an inferior antagonist; the mere consciousness of ability to exterminate the puppy with a single shake satisfies the demands of his nature.

Pleasure, originating in physical activity and reaching a far higher phase in the doing of intellectual work, culminates in the supreme consciousness of power which attends the moral actions. As pointed out by Mr. Stanton Coit,‡ "The conscious fulfillment of duty is attended by a feeling of happiness which sometimes takes the form of deep inward peace, and sometimes of gladness and exultation, like that of a victor." Thus the ancient heathen poet and the modern moralist, although separated by the vast ocean of sympathy which lies between the opposite poles of egoism and altruism, meet nevertheless on the common soil of a common human nature.

Activity, then, carries with it its own reward; it is in itself an end; and education, once almost exclusively directed to the immediate cultivation of the mind, is gradually extending to all the activities of the complex human being—the physical and moral as well as the intellectual. The general methods by which the full measure of development of which human nature is susceptible may be secured are, I believe, indicated in the psycho-physiological facts and principles of which I have here attempted a brief outline.

* Quoted by B. Cattell in "Are Animals mentally happy?" "Nineteenth Century," August, 1886.

† It was one of the teachings of a certain system of theology, now happily nearly obsolete, that the spectacle of the tortures of the damned would constitute one of the elements of heavenly bliss.

‡ See "Mind," No. xliii, "The Final Aim of Moral Action."

Experimental proofs of the efficiency of these methods are also forthcoming. Among them, perhaps, none are more convincing

FIG. 1.—AGE, SIX MONTHS.

FIG. 2.—AGE, EIGHTEEN MONTHS.

than the results secured in the modern training schools for idiots, in which difficult field the late Dr. Edward Séguin, of New York, distinguished himself not only as an investigator of remarkable insight and originality, but as a humanitarian of a high order.

FIG. 3.—AGE, SEVEN YEARS.

At the meeting of the British Association in 1879, Dr. Séguin read a paper entitled "The Training of an Idiotic Hand,"* in which are given the details of his developmental method of teaching in the case of an idiot boy. The training described was applied mainly to the hands, over which the feeble will of the child had almost no control. He was unable to put either his fingers or hands in any given required attitude, although movements of great rapidity and considerable force were involuntarily executed, mainly from the wrist. The sense of touch was also almost wholly want-

* See "Archives of Medicine," October, 1879.

ing. After a year's training (the detailed account of which is most instructive) he is described as having learned to help and amuse himself, and to refrain from biting himself, and from striking his friends, although the hands are still subject, at times, to involuntary movements. The sense of touch has developed to the degree of recognizing about one hundred objects by their shape and texture alone, without the aid of sight. He has also acquired consciousness of the ordinary variations of temperature of water, food, etc. He has been taught to recognize the typical geometrical forms, and to cut them out of paper. He has visited the florists daily, and learned to know and name about sixty different kinds of flowers, all fragrant, thus appealing to the brain through still another sense. This development of the special senses and of volition was accompanied by a marked decline, not only of uncontrolled movements but of outbursts of temper, which had been conspicuous.

At the end of a year's training, concentrated mainly on the hands, the special training of the eyes was begun, the history of which is given in a second paper.*

There was a lack of control over the movements of the eyes quite comparable to that which had existed in the case of the

FIG. 4.—AGE, EIGHT YEARS.

FIG. 5.—AGE, NINE YEARS.

hands. The boy was unable voluntarily either to hold his eyes still or to direct them toward any particular object—rapid oscillations alternating with periods of fixation upward and to one side. In the training of these refractory organs the improved hands were made to give most effective assistance. "What words can not do," says Dr. Séguin, "the hand can; viz., it can present objects to the eye at the proper distance, at the proper opportunity, and with the proper degree of insistence and pertinacity, even fol-

* See "Archives of Medicine," December, 1880.

lowing the eye in its wanderings till it has captured and captivated the regard, . . . keeping the eye at bay, or leading it away from its empty fixedness."

At the end of the second year of training, "the vibrations of the eyes have diminished, his voluntary look has become more steady, and his automatic one less riveted." From the study of objects and movements this no longer idiotic boy was led on to the acquirement of language. At the beginning of training he could repeat only the last word of what was said to him; at the end of the second year he had acquired an accurate though limited vocabulary. Five portraits of the child accompany the reports of this experiment—the first (Fig. 1) taken at six months of age, showing normal development; the second (Fig. 2) at eighteen months (after convulsions), in which idiocy is apparent;* the third (Fig. 3) at seven years, in which the characteristics of idiocy are well marked; the fourth (Fig. 4) at the end of a year's training of the hands, and the fifth (Fig. 5) after a year's training of the eyes. These portraits testify, in a language far more forcible than that of words, to the efficiency of Dr. Séguin's method. The improvement—physical, mental, and moral—as reflected in the last portrait, is most remarkable.† The entire history of this experiment is a history of the triumph of the physiological method of education‡—the only rational method, and as applicable to the sound as to the unsound body and brain. To the physiologist, at least, it must have the value of a complete demonstration of the supreme importance of physical culture in both mental and moral development.

Corroborative testimony of equal or even greater importance may be found in a recent report of the New York State Reformatory at Elmira, to whose resident physician, Dr. Hamilton D. Wey, belongs the distinction of having proposed and carried out the details of an experiment* for testing the effects of physical culture on the mental and moral capacities of an inferior order of adult criminals. Dr. Wey selected for this experiment twelve men ranging from nineteen to twenty-nine years of age, five of whom had been convicted of burglary, four of grand larceny, and three of crimes against the person.

* The fact that idiocy often follows convulsions has a significant bearing on the subject of this paper, since the convulsions of childhood are generally the result of reflex overstimulation of the motor centers of the brain from excessive irritation of the sensory centers brought about by some severe disturbance at the periphery, as in the convulsions of teething.

† We are indebted to the kindness of the Messrs. Putnam for permission to reproduce these portraits.

‡ This includes all that comes under the head of *manual training*.

* See Annual Report of Board of Managers of the New York State Reformatory, January, 1887.

Three of them had been total-abstinence men; eight had indulged in alcoholic drinks occasionally, and one habitually. Several of them confessed to intemperate parents; one had an insane and one an epileptic mother. Many of these men had faces indicative of criminal tendencies; the heads of two were suggestive of idiocy; and among the entire number there was not a face which did not express either mental hebetude or moral obliquity, or both combined.

During the previous two years these men had made no appreciable progress in school-work, seeming incapable of prolonged mental efforts. One of them could neither read nor write; another found great difficulty in doing either; and, although four of them understood the steps necessary for working out a problem in long division, they could never obtain a correct answer, while the remaining eight were "stranded upon the shoals of rudimentary arithmetic from notation to simple division." Some of them were unable even to name the State or country from which they had come. It will be admitted that the proposed test of the value of physical culture was of the severest possible kind.

The physical discipline to which they were subjected consisted in (1) hot baths—three weekly, the Turkish and common bath alternating; (2) massage—kneading of the muscles, passive motions of the joints, and friction of the entire surface; (3) physical exercise—manual drill, free gymnastics and exercise with dumbbells ranging progressively from three to eight pounds in weight; (4) the substitution of a special dietary for the regular prison fare. The experiment was continued during five months—long enough to demonstrate the value of the method, but not to determine the full measure of success probably attainable by these means. At the end of this period, nine of the eleven men then living had risen from the third or refractory to the intermediate grade, the remaining two having merely maintained their original standing in this grade.

During the six months immediately preceding the experiment, the average marking for shop-work, school-work, and conduct had been forty-six per cent. During the experiment, the average for school-work, previously lowest of all, rose to seventy-four per cent, the conduct improving at about an equal rate. Shop-work was discontinued, as the special training was thought to secure enough muscular exercise. During the six months following the term of the experiment, the average marking of the men in the three departments of shop-work, school-work, and conduct rose to seventy-one per cent as compared with forty-six per cent for the six months preceding the experiment. At the end of this period Dr. Wey reported* that "although the men had been remanded to

* See "Science," June 17, 1887.

the former routine of prison life, mental development was still going on; six of the number had reached the first grade in school-work, and two of the remaining five had every prospect of soon doing so."

Physical improvement was marked; their skins had acquired the softness and smoothness of childhood (several having had some form of skin-disease), and their biceps muscles had become worthy of the traditional blacksmith. Their former stooping attitude, slow movements, and shuffling gait had given place to an appearance of alertness and vigor; their faces also had developed an expression of comparative brightness and intelligence. In manual labor the advance was not so pronounced as in other directions, though improvement in this department was marked; but the stride in mental and moral development was almost beyond belief. Dr. Wey, in closing his account of this most interesting test of a new method in prison discipline, says, "I regard my experiment in physical culture as showing that something more than mere brawn can be accomplished by muscular exercise, properly directed."

Inquiries extending over a period of forty years, made of about three hundred members of the Cambridge and Oxford University crews, instituted by Dr. Maclaren, director of the University Gymnasium at Oxford, have elicited facts which may be accepted as experimental evidence of the value of physical training in a class of cases in which the conditions of life are most favorable, hence affording a test from which practically every element except the purely muscular one is eliminated. The benefits experienced by the members of these crews are stated to be an increase of stamina, of energy, enterprise, and executive power, and of fortitude in endurance of trials, privations, and disappointments—"a goodly list of benefits bearing on the mental and moral as conspicuously as on the physical side of the question," says Dr. Maclaren, "for, in the struggle for existence, failure is more likely to result from inability to endure trials and disappointments than from merely physical weakness—the statistics of suicide bearing out this statement." *

The testimony obtained from this source shows that the advantages of physical training are not limited to the idiotic, the ignorant, and the criminal classes, the conditions of whose lives have been especially unfavorable to a normal symmetrical development, but that they belong alike to all; and these widely different experiments, considered together, are calculated to convince the most skeptical mind of the soundness of the several foregoing theses based on certain facts of the development and physiology of the muscular and nervous systems, and on certain principles of

* See Dr. Maclaren's work on training.

psycho-physics and psychology, to which reference has been made. This experimental evidence, having been drawn from observations on the extremes of human capacity and character (exemplified in the young idiot, the adult criminal, and the university student, during the intermediate developmental period), may be accepted as virtually covering the entire ground of human nature in its various phases, and therefore as conclusive of the *universal applicability of systematic physical culture in education.* The cases cited show that in the processes of mental and moral development the muscles, as well as the purely sensory mechanisms, play a conspicuous part; and, while the period of growth is undoubtedly most favorable to this work, Dr. Wey's experiment shows that *even the adult brain and mind may be improved by the various procedures included under the head of physical culture.*

That health has an important bearing upon morals is undoubted.* Count Tolstoï, through the lips of one of his dramatic impersonations, says, "I must have some physical exercise or my character will entirely spoil";† and it is probable that not even the finest examples of human development have attained a height so great, either intellectual or moral, as to be beyond betterment by these means. Descartes testified to the importance of attention to the physical nature in saying, "If it be possible to perfect the human race, it is in medicine that we must seek the means"—employing the term "medicine" in its broad sense as a science devoted to the care of the body. The curative value of physical exercise has long been recognized. Boerhaave said that most of our fashionable diseases might be cured mechanically instead of chemically, by climbing a bitter-wood tree or by chopping it down, rather than by swallowing a disgusting decoction of its leaves and bark. Asclepiades was accustomed to prescribing a course of gymnastics for nearly every form of bodily ailment. Tolstoï also proposes to enrich medicine with a new term, "labor-cure," as a sovereign specific for nervous affections.‡

We have found that activity is in itself an end. The excitement which attends voluntary muscular exercise is a natural stimulant in which all can afford to indulge, since, unlike the artificial stimulants, it adds to the stock by promoting the nutrition of the entire body. Voluntary exercise also tends to develop the general power of volition (including that of self-restraint), which, as we have seen, first appears on the stage of animal life in connection with movements.

But emotions and thoughts as well as movements may be inhibited and brought under control; and it is in this region of

* See author's article, "Hygiene as a Basis of Morals," "Popular Science Monthly," May, 1887.

† See "Anna Karénina."

‡ *Loc. cit.*

mentality that volition reaches its highest phase. Whosoever has attained those "shining table-lands" of human character where force, courage, endurance, and a due degree of altruism perennially abide is in his own person an apotheosis of power, the power whose beginnings we have traced to the muscular activities.

It then appears that in the twofold nature of man the physical and the psychical exist not merely in the relation of simple contiguity, but rather as involved in "the one and indivisible whole" of human existence, and that the psychical—the so-called spiritual—qualities are developed through the physical agents known as the bodily organs, by means of the activities which constitute the functions of those organs.

Said the great Spinoza, whose far-reaching vision penetrated depths beyond the ken of the common mind: "*We do not desire or strive after anything because we think it good; we think it good because we are moved to strive after and desire it.*"

KINSHIP IN POLYNESIA.*

By C. N. STARCKE, Ph. D.,
OF THE UNIVERSITY OF COPENHAGEN.

IN Polynesia, the distinct classes constitute a similar state of things to the family group in the peoples of Asia, since they form an exclusive organization, holding property in common. It is not very clear how these classes arose, but we may assume that they are connected with an earlier distribution into clans, so that the chief represents the eldest line of the posterity of their common ancestor. In some cases this ancestor is supposed to be of divine origin; but we lay no stress on such a supposition, since it probably arose after the chief's position was established. The people are usually in possession of small plots of ground, either as comparatively independent proprietors, or as serfs; the nobles are owners or rulers of small districts, and the king is ruler of the whole. The conditions are in many respects confused and indefinite, yet the type is undoubtedly that of the joint family, or village community.

The classes differ from clans in a natural way. The nobles of different clans belong to one class, and while the clan is usually exogamous, the class always tends to become endogamous. In Polynesia, the definition of the class depends upon the line of kinship, and the classes are not isolated with the exclusiveness of

* From "The Primitive Family," by Dr. C. N. Starcke, "International Scientific Series," vol. lxv, just published by D. Appleton & Co.

castes in India: marriages between the different classes are not absolutely forbidden.

The position of a child born from a marriage between persons of unequal rank may be decided in several ways. The child may either be always assigned to the superior or inferior class, or always either to the father or mother. Polynesia offers us examples of all kinds.

If the father or mother alone belongs to the ruling class, the child is, in the Caroline Isles, assigned to that class.* In the Tonga Isles, the highest class—the Egi, or nobles—inherits rank and property through the mother; the children of the common people (Mataboulas and Tuas) inherit from the father, but belong to the mother's class.† In Otaheite, the children of a marriage between a noble (Hui-Arii) and a woman of a lower class are set aside, unless numerous ceremonies are performed in the temple at the time of the wedding, so as to raise the rank of the inferior person.‡ Both among the nobles and in the intermediate class of landowners the father abdicates in favor of his new-born son, because the son has an additional ancestor, and is therefore of higher rank than his father.#

Marriages are dissolved in the Sandwich Isles at the wish of either party; only in the case of the chiefs there is no divorce, but they form a connection with other women, and their wives take other lovers. These are usually of inferior rank, and the children begotten of such marriages are almost always put to death, probably by the kinsfolk of the higher class, in order that their own importance may not suffer from intermixture with an inferior rank.‖ When we are told that in Hawaii the dignity of chief is inherited through the mother, it must be understood that preference is given to those of the chief's children whose mother is of the highest rank.^ "The wife does not share her husband's rank. The rank of the child is decided by certain definite laws, generally by that of its mother, but also in some cases by that of the father. A woman of noble family who marries one of the common people loses her rank in the event of bearing children to him, in which case she and her children are degraded to her husband's class. The right of inheritance is not decided by priority of birth, but by the fact that the mother is of higher rank than the other wives."◊

This is also the case at King's Mill and in New Zealand.‡ In

* Chamisso, vol. ii, p. 241.

† Martin, vol. ii, p. 101. Rienzi, vol. iii, p. 45. Morgan, "Systems," p. 559.

‡ Ellis, vol. iii, p. 98.

Ibid., vol. iii, p. 100. Cook, vol. i. Hawkesworth, vol. ii, p. 243.

‖ Ellis, vol. i, p. 256; vol. iv, p. 411. ^ Varigny, p. 14.

◊ Chamisso, vol. ii, p. 275. ‡ Wilkes, vol. v, p. 85. Rienzi, vol. iii, p. 142.

the latter country, the man who marries into another tribe or clan takes up his abode in it, and is thenceforward reckoned with his wife's family. It is also usual for the wife to raise her husband to her own rank, while this is not done by the husband.* This fact has been regarded as a survival of a clearly established female line, and a sign of the earlier pre-eminence of the wife; but it seems to me to imply precisely the opposite. Only the prevalent custom of ascribing the child to its father would induce the kinsfolk of a woman of high rank to adopt her husband, in order not to lose their hold upon the children. If the female line were about to disappear, the growing claims of the husband would lead to the adoption of his wife by his own family.

It has been supposed that the strongest proof of the female line is to be found among the Fiji Islanders, but here also the spirit of mature criticism is wanting. We are told that the king is succeeded by his brother, and by his eldest son only in the event of his leaving no surviving brother. The mother's rank and some other circumstances may, however, cause this rule to be violated, so that the younger is preferred to the elder brother.† The chief's practice of extensive polygamy makes it desirable to establish the child's rank by a reference to its mother.‡ The female line can not be deduced from these customs, but a stronger proof is afforded by the institution of the Vasu, which is described as follows: "Most prominent among the public notorieties of Fiji is the *Vasu*. The word means a nephew or niece, but becomes a title of office in the case of the male, who, in some localities, has the extraordinary privilege of appropriating whatever he chooses belonging to his uncle, or those under his uncle's power. Vasus are of three kinds: the *Vasu taukei*, the *Vasu levu*, and the *Vasu*; the last is a common name, belonging to any nephew whatever. *Vasu taukei* is a term applied to any Vasu whose mother is a lady of the land in which he is born. The fact of Mbau being at the head of Fijian rank gives the Queen of Mbau a pre-eminence over all Fijian ladies, and her son a place nominally above all Vasus. No material difference exists between the power of a *Vasu taukei* and that of a *Vasu levu*, which latter title is given to every Vasu born of a woman of rank, and having a first-class chief for his father. *Vasu taukei* can claim anything belonging to a native of his mother's land, excepting the wives, home, and land of a chief. . . . However high a chief may rank, however powerful a king may be, if he has a nephew he has a master, one who will not be content with the name, but who will exercise his prerogative to the full,

* Thompson, vol. i, p. 176. Brown, p. 34.

† Williams and Calvert, p. 18. Appendix xxvi. Rienzi, vol. iii, p. 286. Morgan, "Systems," p. 582; "Ancient Societies," p. 375.

‡ Williams and Calvert, p. 26. Appendix xxvii.

seizing whatever may take his fancy, regardless of its value or the owner's inconvenience in its loss. Resistance is not thought of, and objection only offered in extreme cases. Thokonauto, a Rewa chief, during a quarrel with an uncle, used the right of Vasu, and actually supplied himself with ammunition from his enemy's stores."*

It can not be denied that this great power of the sister's son is very remarkable, and at the first glance it seems only possible to explain it by assuming that there was a peculiar sanctity in the tie of kinship between the man and his sister's son. The extent of the claim is astonishing—a claim which no son would venture to put forward; and this is the more remarkable since the sister's son is not the uncle's heir. In all other cases in which the female line divides father and son, in order to tighten the bond between the mother's brother and sister's son, the analogy with the male line is maintained; that is, the uncle exerts his authority over the sister's son, whereas in this instance their positions are reversed. This arouses a suspicion that ideas unconnected with the female line may have produced the Vasu rights.

On examining more closely the whole institution of the Vasu, we are first struck by the fact that no legitimate rights belong to the common Vasu. These claims can only be made by the Vasu whose mother's brother possesses people and land. It may be assumed that the power of the Vasu in its extreme development was first directed against the mother's brother after it had become an integral part of the political machinery of Fiji, since we are told that the Vasu right becomes an instrument in the king's hand for ruthlessly plundering the land. The king makes use of the Vasu, and shares the plunder with him.† There can be no doubt that the institution of Vasu arose out of the natural reverence with which the subjects regarded the king's sister's son when he visited his uncle. They honored the king through his kinsfolk. The king and his sons ruled after no gentle fashion, and the ruler was entitled to commit all sorts of acts of violence. In this way the honor paid to the king's sister's son enabled him to rob the people freely. The Vasu right was gradually transformed into a fundamental institution, and that which was at first serviceable to the king was now turned against him. It certainly affords no indications of a mystical and religious belief in any special sacred bond between the mother's brother and sister's son.

THE Russian observers of the solar eclipse of August 19, 1887, have expressed the conclusion that the corona has a real existence, and is not merely an optical phenomenon; it having maintained its shape during the whole of the eclipse at each spot where it was observed, and also at spots as far as six thousand miles apart.

* Williams and Calvert, p. 27. † Ibid., p. 27. Appendix xxviii.

SOME OF THE LIMITATIONS OF MEDICINE.*

By STEPHEN S. BURT, M. D.,

PROFESSOR OF CLINICAL MEDICINE AND PHYSICAL DIAGNOSIS, NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL.

IT is a trait peculiar to some minds to believe too much and to others to believe too little. Between these extremes, however, there are many who, though keenly alive to the limitations of medicine, are, at the same time, able to appreciate the great boon it is to mankind. There may be those who would resent the idea of circumscribing our art, but "truth can never be really injurious, whatever phantoms apprehensive ignorance may conjure up around it."

The questions have often presented themselves to me why, after so many years of familiarity with disease, is there such a wide difference of opinion regarding its management? Why is it possible that there are two large schools of medicine opposed in theory if not in practice? Why the endless and surprising consumption of patent remedies? It would seem that more or less superstition still prevails in reference to disease, as well as much ignorance respecting its natural history. I am not well convinced that illness is a necessary concomitant of human existence; and to believe that it is unavoidable is to paralyze all legitimate efforts for its prevention. That it will, at any time, be wholly eradicated is too much to hope, and as Utopian as to expect that a high order of knowledge will ever be universal; nevertheless, great mental attainments and perfect physical health have been realized, and therefore must be accepted as a standard for approximation. Nor is such a realization fortuitous. Long years before our era a wise philosopher of Greece declared that *chance* was nothing more than *cause* unperceived by human reasoning. Now, the welfare of the human race suffers in proportion to the survival of a belief that chance and not some ascertainable cause underlies the evils that endanger it. We are prone to shift the responsibility for our misfortunes upon others, and slow to take the blame on ourselves, where it commonly belongs. Life is certainly a desirable thing under favorable circumstances, and oftentimes we are the makers, or, at least, the modifiers of our environment. As a rule, bad health is the foundation of the greater part of the unhappiness of man. And yet nothing is more positive than that the preservation of good health depends upon a strict observance of the laws of being, which include those of inheritance. Many

* Read before the Clinical Society of the New York Post-Graduate Medical School and Hospital, January 19, 1889.

of these precepts are well understood, but they are by no means generally heeded; for, though life is undoubtedly shortened by ignorance, it is also curtailed by a disregard of what is known—a failure to profit by the understanding. All infringements of the rules of health entail suffering upon the individual, his contemporaries, or his descendants. It is the inability to appreciate that man is but a molecular vibration in the great molar pulsation of life, that allows him to hope that action will ever be not followed by reaction. Furthermore, Nature is never cognizant of extenuating circumstances. Whatever a man's motive, he is equally a victim of a neglect to preserve his bodily well-being, whether his intentions be good or bad. We see death prematurely and with impartiality destroy the just and the unjust. We know that life bears many an old sinner to its utmost limit, and, contrariwise, that goodness is not incompatible with extreme old age. Seeing and knowing these things, are we to shut our eyes and be oblivious to such truths, or are we to awaken to a just appreciation of the invariable relation of cause and effect, however far removed one from the other?

Life has been defined as "the continuous adjustment of internal relations to external relations." Hence, a partial failure of the inner man to meet the successive changes that are going on about him, means incomplete life or disease, and a complete failure of a similar adjustment signifies death. The transmission and the development of characters known as inheritance are made clear by the hypothesis of *pangenesis*, which, therefore, with your permission, let me give: "Every unit or cell of the body throws off gemmules or undeveloped atoms, which are transmitted to the offspring of both sexes, and are multiplied by self-division. They may remain undeveloped during the early years of life or during successive generations; and their development into units or cells, like those from which they are derived, depends on their affinity for and union with other units or cells previously developed in the due order of growth." Here we find an explanation of the manner in which predispositions to disease are probably transmitted, and, what is more, the particular form of inheritance known as *atavism*, or the recurrence of certain features after one or two generations of immunity. I dwell upon this matter of inheritance in order to show how futile the attempt to construct a perfect being out of imperfect material. No amount of therapeutic skill will ever be able to atone for the fatal mistake of unwise parentage. The laws of generation are as applicable to man as to the lower animals. It seems unfair that the child should suffer for the shortcomings of the parent, but the offspring is a continuation of his progenitors, the product of those who have gone before, *plus* his own individuality. Hence, what affects

the child in some degree affects the parent. Indeed, the suffering of a parent over the misfortunes of the child is often greater than that of the child itself. It is important that man should understand the great power that inheritance exerts upon the race for good and for evil, so that he may make a wise departure in the right direction; and that he should know that his daily life so regulates his habits of mind and body that each succeeding day is the sum total of the days that have gone before in its influence upon his future health and movements.

Confucius says: "When you know a thing, to hold that you know it; and when you do not know a thing, to allow that you do not know it—this is knowledge." The laity are of necessity more or less ignorant of the nature of disease. And it would seem that their ignorance is shared by no inconsiderable number of our profession. Every malady pursues a definite course, and ends in restoration, incomplete recovery, or in death. Now, I believe that those medical men who are familiar with the natural history of disease will admit that the milder forms of most acute affections will pass through their various stages and end in recovery without the assistance of a single drug. Moreover, I think they will be obliged to acknowledge that, under the most favorable circumstances and most skilled treatment, many persons die overpowered by the virulence of a malady. The daily record of vital statistics would seem to prove as much. And the pathologists will bear testimony to the fact that where disease, either acute or chronic, has invaded a vital organ, just so much of the tissue as is destroyed remains destroyed and is never reproduced. Have we a broken-down lung? The best that can happen is that the process shall be stopped. Are portions of the kidneys degenerated? We can but save the remainder. Has the liver begun to retrograde into fibrous tissue? We can at best but check the retrogression.

The probable reason that treatment does not keep pace with the rapid advance of pathology is that therapeutics has gone astray, since the only possible solution for some of these difficulties is to seek out the cause and obviate it. A great deal of time and talent have been wasted in a fruitless search for specific remedies for disease, like unto the metaphysicians who have been asking unanswerable questions for hundreds of years about the unknowable.

While it is possible to imagine a community so intelligent as to exist free from the ravages of disease, it is too much for the most sanguine to hope for in the near future. But, notwithstanding this, the history of the recent past assures us that already great strides are being made in the proper direction. Devastating epidemics are less common, because stupidity and superstition

are being overcome by intelligence and a more general recognition of the sequence of cause and effect.

We have many useful drugs, some that are indispensable, but they are mostly double-edged tools to be handled only by trained hands. The man unfamiliar with disease who ventures to administer these drugs because he happens to be acquainted with their names, is very much like the literary aspirant who resorted to opium in the vain hope of becoming a De Quincey.

Whenever the germs of disease gain admission to the body, Nature makes strenuous efforts to throw them off, and, although it takes its own time, it is often successful. For example, fever, by destroying the morbid products that produce it, serves a most useful *rôle* in the restoration of the patient to health. And, as part of nature, the skillful physician stands by in readiness to do his share in furthering the process already initiated. By an intimate acquaintance with the phenomena of disease and the means by which they are manifested, he is enabled to do the right thing at the proper moment, and thus frequently turn the scale toward recovery, when without his intelligent interference the balance might fall in the wrong direction. But the meddlesome interposition of the ill-informed is often productive of great harm. A burning desire to do some impossible thing leads the unwary practitioner into many fatal extravagances. To have the knowledge when not to act, and the moral courage to forbear and give Nature a reasonable chance, are indeed combinations of gifts as desirable as they are rare. From this it follows that the man who recognizes the limitations of medicine is by far the safest adviser. There are no real specifics for disease; and to believe that somewhere in the animal, vegetable, or mineral kingdoms, hidden from the eye of man, there are to be found by diligent search a cure, at least, for each of the many ills that flesh brings upon itself, seems much less rational than to consider all these troubles as induced by violations of laws, known or discoverable, which must be obeyed and can not be evaded. In the scheme of Nature it would have been much simpler to eliminate all pain and disease than to provide occult remedial agents for each, were either alternative within the scope of creation.

No; disease is avoidable to a very considerable extent, if not entirely. And this is possible just in proportion to our knowledge and our will to act thereon. But, because of our ignorance and of our failure to live up to what is known, we are yet far removed from perfect health.

Let us now glance at what we can do. To begin with, we are able to give much instruction regarding the avoidance of disease. We can relieve functional troubles first by the simpler means of rest, food, or exercise, as the conditions demand. We

can quell undue pain. But we can not continue to supply medicines that will take the place of proper living. The man who neglects his own health, and expects the medical profession to make up for his negligence, is somewhat like a person careless of fire in his own house because there happens to be an efficient fire department in town. The flames sometimes get extinguished if the alarm is sounded in time. We can assist Nature in her endeavor to cast out morbid products by various therapeutical expedients. We can remove some of the exciting causes of disease, or else take the patient beyond their reach. We can place him under the most favorable circumstances for Nature to do her work, and at critical moments stimulate the flagging powers and thus bridge over a yawning gulf. We can palliate many of the distressing symptoms of disease, but we can not atone for all the outrageous infringements of Nature's inexorable laws by dosing with drugs, and, moreover, it is not likely that we shall ever be able to do so.

It is possible that we are upon the threshold of a new era in the treatment of infectious and miasmatic diseases, in which new reasons will be found for the survival of old remedies, and many useful additions will be made to our pharmacopœia. The wonderful discoveries of Pasteur in France and of Koch in Germany, and the splendid achievements of the former in his applications of them, seem very fruitful of promise. But, notwithstanding all this, it is much safer to be cautious about mad dogs than to run any undue risks because Pasteur has evolved a means of lessening the terrors of rabies.

And now, in conclusion, I would venture to claim that the answer to my three questions at the beginning of this paper is found in the fact that there is a natural cycle to many diseases wherein there is a tendency toward recovery that, to be sure, is favored or retarded by a multitude of circumstances, but which often takes place irrespective of medication. And this fact is the substratum of all those differences of opinion that are continually arising among superficial observers; is a reason for the survival of many absurd therapeutical theories; is the explanation of the existence of the vagaries of faith and of mind-cures; and, what is perhaps the most lamentable of all, makes it possible for the designing to trade upon the credulity of the public with their oft-times harmful nostrums.

DESCARTES supposed, in 1668, that the displacement of the rocks and the elevations of the surface might be caused by the earth's contraction. Newton expressed a similar thought in 1681, in a letter respecting Dr. Burnet's "Sacred Theory of the Earth," but was careful to add to his hypothesis, "I have not set down anything I have well considered, or will undertake to defend."

SKETCH OF HENRY CARVILL LEWIS.

ALTHOUGH Prof. Lewis died at an age when men usually have hardly more than begun to produce matured work, his name had already become associated with the solution of a most important geological question, and he was recognized as one who had led the science another step forward.

HENRY CARVILL LEWIS was born in Philadelphia, November 16, 1853, and died in Manchester, England, July 21, 1888. He was descended from an ancient patrician family, the Ludewigs, of the free imperial city of Hall, in Swabia, who are mentioned as having occupied as early as the fourteenth century responsible positions as military and civil officers in their city and in the Holy Roman Empire. In the beginning of the eighteenth century, the sons of his ancestor, Johann Peter Ludewig, appear as distinguished in arms and letters. One of them, Johann Peter von Ludewig, besides having other dignities, was a learned jurist and historiographer and poet laureate of the empire, and the author of many historical and legal works. His own ancestor of this generation, Johann David Ludewig, was connected with military and court life. His great-grandfather removed to America in 1784 and anglicized his name to Lewis. His grandfather, John F. Lewis, and his father, F. Mortimer Lewis, were engaged in the East India trade. The latter, since retiring from business, has been actively engaged in various philanthropies in connection with hospitals and benevolent institutions, and is now President of the Pennsylvania Institution for the Deaf and Dumb and of the Children's Hospital of Philadelphia. An incident that occurred when Henry Lewis was little more than an infant is mentioned by his biographer as showing an early inclination toward geological studies. He was found, while on a visit to the country, digging in the gravel-walk with a spoon, and, when asked why he was doing it, replied that he "wanted to see what was underneath." This may have been only a manifestation of childish activity which under other circumstances might not have been noticed and have passed without influence upon his career; but his father and his maternal grandfather, Mr. Henry Carvill, were quick to observe the direction of the dawning intelligence of the boy, and to cultivate whatever profitable tastes he might show. The generous interest taken by his father in fostering the bent of his son's mind toward research deserves, in fact, special recognition and acknowledgment. As soon as his son displayed earnest leanings in this direction, Mr. Lewis provided every facility for helping him in his favorite studies. Instead of attempting, as too

many parents might mistakenly have done, to divert him from this to a more "practical" line of pursuits, he fitted up for him a well-furnished chemical laboratory and workshop; and this laboratory was through all his life a favorite retreat of Carvill Lewis's, to which it was his delight to introduce his scientific friends. His interest in mineralogy and geology assumed a more definite and controlling shape when he was about twelve years old, when Dr. Isaac Lea gave him some specimens as the foundation of a collection, and stimulated him to go on studying them. A year later he and some playmates formed a scientific society, which continued in existence and of which he remained a member till 1875, when it disbanded. Having been graduated from the University of Pennsylvania in 1873 with the highest honors in the classical course, he took a post-graduate course of three years in the natural sciences. For several years after his graduation he divided his time almost equally between geology and astronomy. Twenty-nine communications by him are recorded in the "Proceedings of the Mineralogical and Geological Section of the Academy of Natural Sciences of Philadelphia," from 1877 to 1879. He gave to the American Association in 1877 a description of an aurora and of the zodiacal light as observed by him in May of that year, and notes by him on the zodiacal light were published in the "Proceedings of the American Association" and in the "American Journal of Science" in 1880. In 1879 he joined the Geological Survey of Pennsylvania as a volunteer member, and continued associated with it till 1884. In connection with this work he investigated the surface geology of the southern part of the State, and began the tracing of the great terminal glacial moraine with which his name is most closely associated, determining its course through the northern part of Pennsylvania. In all these researches, as well as his studies in mineralogy and petrology—notably in those relating to the diamond and to the archæan rocks—he was moved by an earnest spirit of independent inquiry, and afforded a living illustration of the force and application of his motto, "Truth for authority, not authority for truth." The controlling force of this principle in his life-work is emphasized in the simple record on his tombstone in Walmsley church-yard, Bolton, "He loved the truth."

In 1880 Mr. Lewis was elected Professor of Mineralogy in the Academy of Natural Sciences, Philadelphia; and in 1883, Professor of Geology in Haverford College. He held both of these positions at the time of his death. From 1885 to 1887 he was occupied during the winters in petrologic studies in Heidelberg with Prof. Rosenbusch, and during the summers in field-work on the glacial geology of England, Wales, Ireland, Switzerland, and northern Germany. The winter and spring of 1887–'88 were

spent in this country, partly in visiting the places in the Southern States where diamonds have been found, in continuance of his investigations on the origin of that gem. He had read papers on the subject at the meetings of the British Association in 1886 and 1887, and was planning to present his further results at the next meeting of that body; after which he hoped to carry on his glacial studies in Norway and other parts of Europe.

He sailed, with Mrs. Lewis, for Europe, on the 3d of July, 1888. He was affected during the latter part of his voyage with symptoms of illness, which developed, after he reached Manchester, England, into typhoid fever. From this he died on the 21st of July. Prof. G. F. Wright, author of "The Ice Age in North America" (New York, D. Appleton & Co., 1889), who was associated with him in the investigation of the terminal glacial moraine, has furnished the estimate which follows, of the general value of his work. The more particularized review of his glacial investigations with which this paper continues, has been furnished us by Mr. Warren Upham, who was also the author of a sketch of Lewis in the "American Geologist."

"It is impossible," says Prof. Wright, "to overestimate the value to the world of such a career as Lewis set before him, and already at his early death had largely realized. His vigor of body and mind, pleasing address, liberal education, high social position, and abundant means, insured to him flattering success in almost any direction. He could easily have attained eminence in the politics of his State and nation. He could have entered upon a business career with fair prospect of becoming a millionaire. Or he could have settled down, as the majority of those thus situated do, to the seductive pleasures of society, and have been one of its chief ornaments. Instead of this, he threw all the resources of his nature and of his position into the most laudable work of enlarging the stock of the world's knowledge.

"The leisure hours of his boyhood were spent in his laboratory and in roaming over the hills in the vicinity of Philadelphia in search of facts to explain their origin. After graduating from the university, he offered himself as an assistant to the Geological Survey of the State, and for one or two seasons accompanied the surveyors in the dull routine of their work. He afterward was commissioned to prosecute independently investigations into the nature of the gravel deposits of the rivers entering the Atlantic between New York and Norfolk, Va. It was with the results of these youthful investigations that he came to the meeting of the American Association for the Advancement of Science at Boston, in 1880, with two or three papers which at once attracted the attention both of that body and of the wider audience reached by the printed reports. Lewis was specially delighted on that occa-

sion by the approval of his work which was given by the venerable Prof. W. B. Rogers, then at the head of the Massachusetts Institute of Technology, and for so long a time connected with the Geological Survey of Pennsylvania and the adjoining Appalachian region.

"During all his earnest search for the truths of Nature, Lewis was stimulated by the thought that man does not live by bread alone, but that he who ministers to the mental wants of the race by discovering truth and bringing it within reach of the general apprehension is as truly a philanthropist as he who ministers to their bodily comfort. In all these aims it is gratifying to know that his wife most heartily coincided. A great truth of Nature, like the wonderful history of the Glacial period, when it finds its way into the school-books of the children and into works of general literature, is of incalculable utility in the intellectual development of mankind."

"Prof. Lewis first became specially interested," writes Mr. Upham, "in the glacial drift and its terminal moraine during the latter part of the year 1880, when, in company with Prof. G. F. Wright, he studied the remarkable osars of Andover, Mass., the gravel of Trenton, N. J., containing palæolithic implements, the drift deposits of the vicinity of New Haven, Conn., under the guidance of Prof. Dana, and finally the terminal moraine in eastern Pennsylvania between the Delaware and Lehigh Rivers. The following year Profs. Lewis and Wright traversed together the southern border of the drift through Pennsylvania from Belvidere, on the Delaware, west-northwesterly more than two hundred miles across the ridges of the Alleghanies, to Little Valley, near Salamanca, N. Y., and thence southwesterly one hundred and thirty miles to the line dividing Pennsylvania and Ohio, which it crosses about fifteen miles north of the Ohio River. The report of this survey of the terminal moraine was published in 1884, forming Volume Z of the reports of progress of the Second Geological Survey of Pennsylvania.

"With the similar exploration of other portions of this great moraine done a few years earlier by Prof. Chamberlin in Wisconsin, Profs. Cook and Smock in New Jersey, and Mr. Warren Upham in Long Island, thence eastward to Nantucket and Cape Cod, and also in Minnesota, it completed the demonstration of the formation of the North American drift by the agency of land-ice.

"The observations of the moraine in Pennsylvania, detailed in this volume, are summarized by Prof. Lewis as follows: 'The line separating the glaciated from the non-glaciated regions is defined by a remarkable accumulation of unstratified drift material and bowlders, which, heaped up into irregular hills and

hollows over a strip of ground nearly a mile in width, forms a continuous line of drift-hills (more or less marked) extending completely across the State. These hills vary in height from a few feet up to one hundred or two hundred feet, and, while in some places they are marked merely by an unusual collection of large transported bowlders, at other places an immense accumulation forms a noteworthy feature of the landscape. When typically developed this accumulation is characterized by peculiar contours of its own—a series of *hummocks*, or low, conical hills, alternate short, straight ridges, and inclosed shallow basin-shaped depressions, which, like inverted *hummocks* in shape, are known as *kettle-holes*. Large bowlders are scattered over the surface, and the unstratified *till* which composes the deposit is filled with glacier-scratched bowlders and fragments of all sizes and shapes.'

"From its lowest point in Pennsylvania, where it crosses the Delaware, 250 feet above the sea-level, this terminal moraine extends indiscriminately across hills, mountains, and valleys, rising over 2,000 feet above the sea in crossing the Alleghanies, and attaining the maximum of 2,580 feet on the high table-land farther west, being there 'finely shown at an elevation higher than anywhere else in the United States.'

"Preliminary outlines of Prof. Lewis's work on the glacial drift of England, Wales, and Ireland are given by his papers in the reports of the British Association for 1886 and 1887; and the first of these also appeared in the 'American Naturalist' for November, and the 'American Journal of Science' for December, 1886. Their most important new contribution to knowledge consists in the recognition of the terminal moraines formed by the British ice-sheet, which Lewis traced across southern Ireland from Tralee on the west to the Wicklow Mountains and Bray Head, southeast of Dublin; through the western, southern, and southeastern portions of Wales; northward by Manchester and along the Pennine chain to the southeast edge of Westmoreland; thence southeast to York, and again northward nearly to the mouth of the Tees; and thence southeastward along the high coast of the North Sea to Flamborough Head and the mouth of the Humber. It is a just cause for national pride that two geologists of the United States—Lewis in Great Britain in 1886, and Salisbury the next year in Germany—have been the first to discover the terminal moraines of the ice-sheets of Europe. Like the great moraines of the interior of the United States, those of both England and Germany lie far north of the southern limit of the drift.

"Another very important announcement by Prof. Lewis relates to the marine shells, mostly in fragments and often worn and stri-

ated, found in morainic deposits and associated kames 1,100 to 1,350 feet above the sea, on Three Rock Mountain, near Dublin, on Moel Tryfan in northern Wales, and near Macclesfield in Cheshire, which have been generally considered by British geologists as proof of marine submergence to the depth of at least 1,350 feet. These shells and fragments of shells, as Lewis has shown, were transported to their present position by the currents of the confluent ice-sheet, which flowed southward from Scotland and northern Ireland, passing over the bottom of the Irish Sea, there plowing up its marine deposits and shells, and carrying them upward as glacial drift to these elevations, so that they afford no testimony of the former subsidence of the land. The ample descriptions of the shelly drift of these and other localities of high level, and of the lowlands of Cheshire and Lancashire, recorded by English geologists, agree perfectly with the explanation given by Lewis, which indeed had been before suggested, so long ago as in 1874, by Belt and Goodchild. This removes one of the most perplexing questions which geologists have encountered, for nowhere else in the British Isles is there proof of any such submergence during or since the Glacial period, the maximum known being 510 feet, near Airdrie, in Lanarkshire, Scotland. At the same time the submergence on the southern coast of England was only from ten to sixty feet, while no traces of raised beaches or of Pleistocene marine formations above the present sea-level are found in the Orkney and Shetland Islands. The work and writings of Prof. Lewis emphasize the principle that glacially transported marine shells and fragments of shells, which occur in both the till or bowlder-clay and the modified drift in various parts of Great Britain, are not to be confounded with shells imbedded where they were living, or in raised beaches, for only these prove the former presence of the sea.

"The drift deposits of England south of the terminal moraines traced by Lewis were regarded by him as due to floating ice upon a great fresh-water lake, held on the north by the barrier of the ice-sheet which covered Scotland, northern England, and the area of the North Sea, and on the southeast by a land-barrier where the Strait of Dover has since been eroded. Under this view he attributed the formation of the Chalky bowlder-clay in East Anglia and of the purple and Hessle bowlder-clays in Lincolnshire and much of Yorkshire to lacustrine deposition, and believed that there was only one advance and recession of the ice-sheet. But shortly after the British Association meeting in 1887 his observations on Frankley Hill in Worcestershire and thence westward led him to accept the conclusion, so thoroughly worked out by other glacialists both in America and Great Britain, that there were two principal epochs of glaciation, divided by an intergla-

cial epoch when the ice-sheet was mostly melted away. There can be little doubt that the continuation of Lewis's study of the drift in England, if he had lived, would have soon convinced him of the correctness of the opinions of Searles V. Wood, Jr., Mr. Skertchly, and James Geikie, that land-ice during the earlier Glacial epoch overspread all the area of the Chalky bowlder-clay, extending south to the Thames. Small portions of northern England, however, escaped glaciation both then and during the later cold epoch when the terminal moraines mapped by Lewis were accumulated; and these tracts of the high moorlands in eastern Yorkshire and of the eastern flank of the Pennine chain are similar to the driftless area of southwestern Wisconsin.

"Comparison of the drift in the United States and Great Britain enabled Prof. Lewis to refer the British modified drift, both that often intercalated between deposits of till and that spread upon the surface in knolly and hilly kames and more evenly in plains and along valleys, to deposition from streams supplied by the glacial melting, the material being washed out of the ice-sheet. These beds, however, are to be carefully distinguished from those of interglacial and post-glacial age. It is greatly to be regretted that this sagacious observer was not spared for the fulfillment of his plan of yet more extended study of European glacial deposits in the light of his wide knowledge of the terminal moraine and other drift formations in this country."

Prof. Lewis was a member of the American and the British Associations; of the American Philosophical Society, the Academy of Natural Sciences, and the Franklin Institute, in Philadelphia; of the Geological Society of Liverpool; and a Fellow of the Geological Societies of London and Germany.

He was married in 1882 to a daughter of the late William Parker Foulke, of Philadelphia, who, with a daughter, survives him, and will transfer his unfinished papers, for completion, to the distinguished geologists who have generously offered their assistance. He possessed a strong Christian faith, and was an active member of St. Michael's Protestant Episcopal Church, Philadelphia, of whose Sunday school he was for many years a teacher, and for a long time superintendent. He had the happy faculty of imparting knowledge to those whom he taught, and in making his instructions interesting and agreeable. With a high character, a pure standard of manhood, fine mental and physical powers, a wide range of scholarship, a happy, genial, and enthusiastic temperament, rare perseverance and industry, and a lofty devotion to the interest not only of science but of mankind, his life seemed to promise the widest usefulness and honor.

The following list of Prof. Lewis's published papers is abbreviated from the "American Geologist":

1876. "On Strontianite and Associated Minerals in Mifflin County, Pennsylvania."

1877–'79. Twenty-nine communications to the Mineralogical and Geological Section of the Academy of Sciences of Philadelphia.

1880. "Note on the Zodiacal Light: The Aurora and Zodiacal Light of May 2, 1877."

1880. "The Antiquity of Man in Eastern America, geologically considered."

1880. "The Iron Ores of the Brandon Period."

1881. "The Antiquity and Origin of the Trenton Gravel."

1882. Fifteen communications to the Academy of Natural Sciences of Philadelphia.

1882. "Volcanic Dust from Krakatoa."

1882. "The Great Terminal Moraine across Pennsylvania."

1882. "Note on the Aurora of April 16 and 17, 1882."

1882. "Map of the Terminal Moraine."

1883. Eight communications to the Academy of Natural Sciences of Philadelphia.

1883. "The Great Ice Age in Pennsylvania."

1883. "The Geology of Philadelphia."

1884. "Report on the Terminal Moraine in Pennsylvania and Western New York. Illustrated by a Map of Pennsylvania, showing the Glaciated Region, etc."

1884. "A Phosphorescent Variety of Limestone."

1884. "Supposed Glaciation in Pennsylvania south of the Terminal Moraine."

1884. "Marginal Kames."

1884. "An Interesting Mineral (Cacoclasite) from Canada."

1885. "On a New Substance resembling Dopplerite, from a Peat Bog at Scranton."

1885. "A Great Trap Dike across Southeastern Pennsylvania."

1885. "Erythrite, Genthite, and Cuprite from near Philadelphia."

1885. "The Direction of Glaciation as ascertained by the Form of the Striæ."

1885. "Some Examples of Pressure Fluxion in Pennsylvania."

1886. "Comparative Studies upon the Glaciation of North America."

1886. "On a Diamantiferous Peridotite and the Genesis of the Diamond."

1887. "The Terminal Moraines of the Great Glaciers of England."

1887. "On Some Important Extra-Morainic Lakes in Central England, North America, and elsewhere, during the Period of Maximum Glaciation, and on the Origin of Extra-Morainic Bowlder-Clay."

1887. "The Matrix of the Diamond."

1887. "On the Terminal Moraine near Manchester."

1887. "Accounts of Some so-called 'Spiritualistic' Séances."

1888. "Diamonds in Meteorites."

CORRESPONDENCE.

AWAKENING THOUGHT.

Editor Popular Science Monthly:

YOUR article upon "Learning to think," in the April number of your magazine, treats upon a great need.

To make it yet more helpful to those who wish to know how to ask questions, either to awaken thought or to elicit information from others, will you kindly suggest, in a future number, some leading "questions arranged under certain categories," for further instruction by way of example?

In behalf, I believe, of many educators,

A MOTHER.

WORCESTER, MASS., *May* 1, 1889.

ANIMAL ALTRUISM.

Editor Popular Science Monthly:

IN G. J. Romanes's chart of the "Derivative Origin of the Human Mind"* he marks "Sympathy" in the scale on the level or line 24 with "communication of ideas," on which level or line is also placed "Hymenoptera."

The writer has not studied Mr. Romanes enough to understand his chart, and therefore can not see why the *Hymenoptera* are there placed, except it be that in that class of insects the communication of ideas is earliest seen. He does not note altruism in the chart.

It seems to me altruism is allied to "sympathy," and to the maternal faculty of affection. At first thought it seemed as if altruism might be the outgrowth of maternal love and regard. But two instances of its manifestation in members of a colony of domestic fowls appear to be adverse to that conclusion. These may be described in detail.

A relative of the writer, Mrs. R——, of Stockton, was occupied in 1881 with the care and study of several dozen chickens. One day she was feeding them meat cut in small pieces, and most of her feathered family gathered around and fed from her hand. But one little white pullet was too timid to come up and get her portion. A strong gray chicken, nearly full grown, and which sustained no family kinship to the other, seemed to observe and take in the forlorn situation of the one standing back, began to fight, and tried to drive away the cluster, as if to make room for the lagging associate. But it did not stir or move toward the feeding group. The gray, failing in that effort, boldly came forward, took a fragment of meat, carried it to the hungry chicken and dropped it at its feet, and then moved away, as if it had done a useful and friendly act.

On another and subsequent occasion, Mrs. R—— was again feeding her poultry from her hand. As she appeared, they hurried out from under a sheltered retreat, and with natural eagerness each swallowed its coveted portion. But one Black Spanish member timidly remained behind under cover, though in sight. After devouring a few pieces of meat, a vigorous brown Leghorn seized a good-sized piece, ran to a corner, and hid it. She then went to the retreat and induced the backward party to go out. They two went to the place of concealed store, when the Leghorn brought forth the reserved morsel of meat and dropped it before her companion, which at once accepted the gift.

Here are two examples of the altruistic faculty developed in members of the body politic of domestic fowls. As these instances are found in young individuals wherein the maternal faculty of love and regard for offspring has never been called in action, must we not conclude that altruism in them is an outgrowth of energies remote from the maternal characteristic? The immediate mother of those chickens was the incubator.

It is of interest to determine how early in the growth of mind altruism can be perceived.

A. S. HUDSON, M. D.

STOCKTON, CAL., *April* 1, 1889.

* "Popular Science Monthly," April, 1889.

DO CATTLE COUNT?

Editor Popular Science Monthly:

READING, not long ago, a sketch in our local paper, entitled "Can Animals count?" said to have been taken from "The Popular Science Monthly," recalls to my mind an incident that I have heard my father relate.

My grandfather Butterfield kept a hotel on the Green Mountains, five miles from Manchester, Vermont, more than a hundred years ago. It was his custom to salt his cattle every Sunday morning.

After vegetation started in the spring he would turn his young stock into the forest to get their living, being short of cleared pasturage.

These cattle would remain away a week, but would invariably come to the barn every Sunday for their salt, and after eating it would return to the woods again.

Now, if this does not prove that animals can count, it proves that they are creatures of very regular habits.

SUSAN M. B. STAPLIN.

MANNSVILLE, JEFFERSON COUNTY, N. Y.

EDITOR'S TABLE.

THE STIMULATION OF THOUGHT.

ON another page we print a letter from "A Mother," whom we are happy to find interested in the subject of our recent editorial article, "Learning to think." We are not sure that we can fully meet our correspondent's demand for a series of "questions arranged under certain categories" for the purpose of drawing out thought, seeing that the questions would necessarily vary to a great extent with the subject. As we pointed out before, however, what is of chief importance is to keep alive a sense of relation between the particular thing that occupies attention for the moment and other things. A vast number of practical errors lie in neglecting the category of *cause*. The question Why? is one that can hardly be asked too often, provided only it is asked with a sincere desire for information and not in a spirit of evasion or obstruction. Children often ask Why? simply to gain their own ends, not with any intention of yielding to the reasons given. This spirit, of course, has to be repressed as far as possible, but too much encouragement can not be given to an observing, inquiring disposition.

Whatever the intellectual task in hand, we should adjust ourselves to it, with the intention of seeing the subject, as far as may be, in its true proportions and complete bearings. We know what it is to sit opposite an object so as to get a good, fair, and square view of it. So with our intellectual tasks: we should shift our position till we feel that we are so situated as to take in all that we can take in of them. Instead of this, however, how common a thing it is for people, old and young, to take but a hasty, *angular* glance, so to speak, at what they have to deal with, and so fail to see its most important and really conspicuous features! Before questions can be asked to any good purpose, there has to be careful observation; and before there can be careful observation, the object must be placed in the center of the field of vision. Whatever we see we should try to realize first in its entirety, as consisting of such and such related and convergent parts; and afterward we should examine it analytically, in order to obtain a better knowledge of the parts, from which may flow a better insight into their relations. It is one thing to know that a key fits a lock, and another to be able to figure to ourselves the wards or compartments in the lock that exactly answer to the pattern of the key. It is one thing to know that a certain action is predicated of a certain subject, and another to understand that the predicated action was a natural product of the attendant circumstances. The habit of classification is one that can be taught with comparative ease to the young; and it is one that gives rise to many useful questions. It continually raises the question, "What is it?" and teaches the habit of going behind first appearances. We can not ask in regard to anything: To what class does it belong? without also asking: What is it like? What is it unlike? Then, when the class is recognized, there arise questions of relation to other classes, etc., questions of origin, of function, of cause and effect, of purpose, of significance, and many others. To develop our theme fully would be to write an essay on pedagogics. To sum up, we may say that the great desideratum is to establish a healthy action and reaction between the mind and the environing world. Some minds set up this action and reaction, this interchange of impressions and conceptions, for themselves; others need

more or less help, and that help can best take the form of placing them, as we have expressed it, fairly opposite successive objects of study, and leading them to ask, one by one, the questions necessary to draw out all the information obtainable in regard to these. The educator who makes all education practical—that is to say, who keeps the idea of rational *purpose* ever in the foreground — will certainly accomplish better results, in the way of developing thought, than one who teaches with only an occasional reference to purpose. We can not say more on this subject at present; but, as it is one of great importance, and seems to be of special interest to not a few of our readers, we may attempt further elucidations at a future day.

THE WORK OF PRESIDENT BARNARD.

THE death of ex-President Barnard, of Columbia College, has removed from among us one of the most successful and far-sighted of American teachers. Dr. Barnard was a leader in advancing educational movements; among the foremost in steps to enlarge the scope and improve the methods of academic instruction. His early training and associations might have been expected to make him a conservative; but they did not. While prizing and keeping what was good in the old theories and forms, he was a pioneer in the movement that has liberalized the courses of university studies and given them greater flexibility and adaptation. During the very years previous to 1860, when he was closely associated with institutions which seem to have been crystallized in the formality of the ancient traditions, and with men wedded to them, he was maturing those views which, foreshadowed in his papers and reports on "College Government," "Collegiate Education," "Art Culture," "The Improvements practicable in American Colleges," "The Relations of University Education to Common Schools," and "University Education," he carried out in the latter part of his career.

Notwithstanding its advantages of age and endowment, Columbia College, when Dr. Barnard was called to its presidency in 1865, was not occupying a conspicuous position. His accession to the presidency was nearly coincident with the removal of the college to its present location and the establishment of the School of Mines. These were fortunate events which contributed their share to the growth of the college. But the prosperity of the School of Mines itself, which has become one of the foremost American scientific schools, is largely accredited to his executive ability, conjoined with the fidelity of the Board of Instructors who were happily associated with him. While always urging the giving of increased prominence to scientific studies, he did not lose sight of the value of the other departments. He rather sought and secured a symmetrical development all around; so that, as one of the most temperate summaries that we have noticed of the result of his work records, "under his administration Columbia has made steady progress, until he was able in his last years to foresee a future in which the institution shall grow into the dignity of a university worthy of the metropolis." During the last year of his active service Columbia is said to have had the highest enrollment of any college in the country.

President Barnard was successful because he was an original and independent thinker and a prompt executor; because he was quick to discern what was good and ready to accept it. He was neither too strongly attached to the old and established, nor so radical as to grasp at visions and try to force changes. Regarding education as something that must grow and be developed, he looked constantly forward, judged everything by its merits, and seized and made the best of whatever he found that was good.

The avowal of principles and acceptance of innovations that flew in the face of the custom of the ages often demanded much courage, but he never lacked it; and the wisdom of his course was usually justified in the event.

The opening of the School of Mines gave an opportunity to enlarge the plan of studies in favor of science, and to encourage the preference of students who desired to give it predominant attention. Similar liberality toward other departments facilitated the ultimate adoption of elective studies. This is a factor that is changing the whole aspect of college life. Columbia College is not alone in the movement toward flexibility in the curriculum; but it is most largely due to President Barnard that it is in it at all, and has been able to turn it to advantage. It can not be doubted that his positive attitude and example have been influential in promoting its extension and its advance elsewhere. The truth of the remark with which our "sketch" of Dr. Barnard in May, 1877, opened—that few men among the promoters of science and liberal culture in our time had labored more efficiently and successfully than he—was made more and more plain during the succeeding years of his life, and was never more evident than on the day when he resigned the presidency of Columbia College.

LITERARY NOTICES.

THE AMERICAN COMMONWEALTH. By JAMES BRYCE, M. P. London and New York: Macmillan & Co. Two Volumes. Price, $6.

THE comprehensiveness and importance of Mr. Bryce's book place it with Von Holst's great work in the first rank of treatises on the political institutions of America. It is not a history, though its statements are elucidated here and there by historical material; it is not a treatise on constitutional law, though the general character and notable features of the Federal and the several State Constitutions are pointed out; its fifteen hundred pages comprise an account of the present condition of the American nation. In the words of the author, "There are three main things that one wishes to know about a national commonwealth, viz., its framework and constitutional machinery, the methods by which it is worked, the forces which move it and direct its course." These three things it has been his task to tell about the United States. Part I deals with the three divisions of the Federal Government—the executive, the legislative, and the judicial. It describes the relations of the national power to the several States. It discusses the nature of the Constitution and shows how this stable instrument has been in a few points expressly, in many others tacitly and half-unconsciously, modified. Part II deals similarly with the State governments. There is also given some account of the systems of rural and city government which have been created in the various States. Mr. Bryce commends our rural governments, but condemns the government of our cities as "the one conspicuous failure of the United States." Part III contains a sketch of the party system and of the men who "run" it. The author is conscious of especial difficulties in making such a sketch, because the system is so different from what a study of the Constitution would suggest, because there are no existing authorities on the subject, and knowledge must be gleaned from newspaper articles, conversation, and a variety of occurrences, which together constitute a floating and uneven basis for the work. But what Mr. Bryce deems the most difficult and most vital part of his task is to describe public opinion in America, and this subject forms Part IV. Public opinion, he says, "stands above the parties, being cooler and larger-minded than they are; it awes party leaders and holds in check party organizations. No one openly ventures to resist it. It determines the direction and the character of national policy. It is the product of a greater number of minds than in any other country, and it is more indisputably sovereign." In order to illustrate the statements made in treating of parties and public opinion, the author gives in Part V accounts of the Tweed Ring, the Philadelphia Gas Ring, and Kearneyism. He follows these with discussions of territorial extension, the *laissez-faire* doctrine, and women's suffrage,

and then passes to an estimate of the strength and weakness of democratic government as it exists in the United States, and a comparison of the facts with European speculation about democracy in general. Part VI is of a somewhat different character from the preceding portions of the work, dealing with the social institutions of the United States, but these, as the author says, "count for so much in the total life of the country, in the total impression which it makes and the hopes for the future which it raises, that they can not be left unnoticed." In footnotes and appendixes to both volumes much matter illustrative of the text is supplied. Among these materials are an account of "the lobby," and a newspaper description of a scene in a presidential nominating convention. Mr. Bryce is not inclined to credit so much influence to democracy in making America what it is as preceding writers have done, or as Americans are fond of doing. "A close analysis of social and political phenomena," he says, "often shows us that causes are more complex than had at first appeared." He finds many things to condemn in our political system, as any honest critic must, but he is not pessimistic in regard to our future. He is convinced of "the existence in the American people of a reserve of force and patriotism more than sufficient to sweep away all the evils which are now tolerated, and to make the politics of the country worthy of its material grandeur and of the private virtues of its inhabitants. America excites an admiration which must be felt upon the spot to be understood. The hopefulness of her people communicates itself to one who moves among them, and makes him perceive that the graver faults of politics may be far less dangerous there than they would be in Europe. A hundred times in writing this book have I been disheartened by the facts I was stating; a hundred times has the recollection of the abounding strength and vitality of the nation chased away these tremors." If there is not much in these volumes that the well-informed American is not aware of, there is a great deal in them that Americans do not sufficiently think of, while to the English reader it furnishes a broad, truthful, appreciative view of the great republic of the New World.

THE HISTORY OF ANCIENT CIVILIZATION. Edited by Rev. J. VERSCHOYLE. New York: D. Appleton & Co. Pp. 295. Price, $1.75.

THIS hand-book is intended to give a comprehensive view of ancient civilization in Egypt, Mesopotamia, and other quarters of "the East," as well as in Greece and Rome, in order to bring them out in their relations with one another and show the chain of dependence, without an understanding of which their succession and development can not be adequately comprehended. The civilization of Rome, "which was the outcome of corporate action," was most largely influenced by that of Greece, which was "the outcome of individual thought," and this runs back into the various civilizations of the East. The precise nature and extent of the influence of these civilizations upon Grecian development have not been defined, but are at this moment more than ever before the subject of active study. The author does not attempt to measure them, but gives comprehensive though succinct descriptions of the civilizations so far as they have been made out, beginning with "the beginnings of civilization," and bringing under review in succession, "The Monuments and Art of Egypt," "The Babylonians and Assyrians," "The Religion and Social State of the Jews," "Phœnician Commerce," and "The Civilization of the Aryans, Hindoos, and Persians." Greek civilization is treated under the heads of "Religion," "Politics," "Literature and Art," and "The Diffusion of Greek Genius"; "The Roman World" under those of "The Republic," "The Conquests of Rome—Transformation of the Republic," "Roman Society under the Empire," and "Latin Literature and Art." The work is based on M. Ducoudray's "Histoire sommaire de la Civilisation"; but, while a translation was made by an experienced hand, it can not, in its present form, be called a translation, for a large part of it has been rewritten.

HOW TO STUDY GEOGRAPHY. By FRANCIS W. PARKER. International Education Series, Vol. X. New York: D. Appleton & Co. Pp. 400. Price, $1.50.

THE equipment of the teacher must include both an understanding of educational theory and an acquaintance with educational practice. The present volume, as indicated by its title, is designed to contribute to the

latter of these qualifications. It consists of plain and detailed directions for teaching a knowledge of the earth's surface. The general forms of river basins are first taught with the aid of diagrams. The structure of each of the continents is then shown in the same way. Next, attention is drawn to a large number of points which together give a view of the world as a whole, among these being the relative positions of the continents, relations of continents to oceans, distribution of heat, ocean currents, winds, distribution of moisture, of vegetation, of animals, of races of men, and of minerals, and political divisions. A brief outline of a course of study is given, and this is followed by a chapter of general suggestions and directions. One direction which the author ranks above all others is that the pupil should form the habit of "locating every place, natural feature and country, mentioned in reading and study," the best chance for this being found in the study of history. He indorses the use of relief maps, after considering the objections to them, and recommends map-drawing. He maintains that "in the art of questioning is concentrated the art of teaching," hence the "Notes on the Course of Study," which occupy about half of the volume, largely consist of questions. These may be used as they stand by the teacher in giving lessons, and should also serve the higher purpose of a model from which the teacher may learn the art of original questioning. The course of study is marked out in grades, and the "Notes" are followed by a list of books and maps suitable for supplementary reading and reference in each grade. Essays on "Spring Studies in Nature," "Weather Observations," "The Study of Geography," and "Relief Maps and their Construction," by various writers, are appended. This book can not fail to be an important aid to the teacher in changing geography lessons from a mere drudgery for the memory to a real study of the earth's surface.

THE MIND OF THE CHILD, PART II. THE DEVELOPMENT OF THE INTELLECT. By W. PREYER. Translated from the German by H. W. Brown. New York: D. Appleton & Co. "International Education Series." Pp. 317. Price, $1.50.

THE former volume of the relation of Prof. Preyer's investigations on the mind of the child contained those parts devoted to the development of the senses and of the will. The present volume contains a third part, which treats of the development of the intellect. Three appendixes are added, containing supplementary matter. The author, considering that the development of the power of using language is the most prominent index to the unfolding of the intellect, devotes the greater part of the volume to that branch of the subject. The question whether there can be thought without words, which Max Müller has made a living one, holds a first place in the discussion. The author's opinion on this subject is clear and expressed without reserve, and is opposed to the view which Dr. Müller maintains. The thinker, who has long since forgotten the time when he himself learned to speak, can not give a decided answer to the question; for he can not admit that he has been thinking without words, "not even when he has caught himself arriving at a logical result without a continuity in his expressed thought. . . . But the child not yet acquainted with verbal language, who has not been prematurely artificialized by training and by suppression of his own attempts to express his states of mind, who learns of *himself* to *think*, just as he learns of himself to see and hear—such a child shows plainly to the attentive observer that long before knowledge of the word as a means of understanding among men, and long before the first successful attempt to express himself in articulate words—nay, long before learning the pronunciation of a single word, he combines ideas in a logical manner—i. e., he *thinks*." This position is sustained by numerous illustrations and citations of incidents; and the case of uneducated deaf-mutes is regarded as demonstrating that thought-activity exists without words, and without signs for words. In our own only half-remembered experiences, the author says, "it was not language that generated the intellect; it is the intellect that formerly invented language; and even now the new-born human being brings with him into the world far more intellect than talent for language." The acquisition of speech belongs to the unsolved physiological problems. As a help to the investigation, a parallel is drawn between the child that does not yet speak and the diseased adult who

no longer has command of language, in the light of which the organic conditions of learning to speak are considered, with important physiological results. The development of speech in the child during the first three years is described from observations on the author's own infant. The growth of the feeling of self, or the "I" feeling, is examined in a like manner; and the results are summarized, particularly as they bear upon the theory of the formation of concepts without language. In the appendixes are given "Comparative Observations concerning the Acquirement of Speech by German and Foreign Children"; "Notes concerning Lacking, Defective, and Arrested Mental Development in the First Years of Life"; and reports of several cases illustrating the process of learning to see, on the part of persons born blind, but acquiring sight through surgical treatment. A full conspectus, showing the results of Prof. Preyer's observations in a chronological order, arranged by months, is added by the translator, and very greatly augments the value of the book.

POPULAR LECTURES AND ADDRESSES. By Sir WILLIAM THOMSON. In Three Volumes. Vol. I. CONSTITUTION OF MATTER. With Illustrations. London and New York: Macmillan & Co. Pp. 460. Price, $2.

THE first lecture included in this volume deals with capillary attraction, explaining with the aid of diagrams the action of the forces which produce capillary phenomena. There are two lectures on electrical measurements: one describing how the units in present use have been arrived at and pointing out certain things in relation to them which should be advanced and perfected; the other dealing mainly with the construction of electrometers. The collection contains an extended discussion of the size of atoms, and an address entitled "Steps toward a Kinetic Theory of Matter." The most popular address in the volume is entitled "The Six Gateways of Knowledge," and deals with the senses, including among them the temperature-sense. Prof. Thomson says there is no evidence for the existence of a magnetic sense. Another attractive paper to the general reader is a lecture on the wave theory of light, delivered in Philadelphia. There are two lectures on the sun's heat, one of which considers the probable limits to the periods of time past and future during which the sun can be reckoned on as a source of heat and light. The second volume of this series will include subjects connected with geology, and the third will be chiefly concerned with phenomena of the ocean and with maritime affairs.

SEVENTH ANNUAL REPORT OF THE UNITED STATES GEOLOGICAL SURVEY TO THE SECRETARY OF THE INTERIOR—1885-'86. By J. W. POWELL, Director. Washington: Government Printing-Office. Pp. 656, with Plates.

THE report begins with an explanation of the purposes of the geographic division of the survey and the object of the topographic maps and methods of preparing them. In the geologic division the adoption of a scheme of taxonomic representation that shall be comprehensive and susceptible of extension as new features come to light is shown to be important. The perfection of the work of the survey has made necessary the establishment of accessory divisions of paleontology, chemistry, microscopic petrography, statistics and technology, forestry, and illustrations; and, in order that needed facilities may be provided for the consultation of the results obtained by other geologists, a library of 17,255 books, 19,600 pamphlets, and 9,000 maps, has been collected. Topographic surveys were carried on during the year over 81,829 square miles, at an average cost of about $2.75 per square mile. In the distribution of the work, the investigation of the archæan rocks has been conducted under the direction of Prof. Raphael Pumpelly; investigations of the Atlantic coast, including changes of level, by Prof. Shaler; in the Appalachian region, by Mr. G. K. Gilbert; in the Lake Superior region, by Prof. R. D. Irving; in Glacial Geology, by Prof. T. C. Chamberlin; in Montana, Yellowstone Park, Colorado, California, Volcanic Geology, the Lower Mississippi region (iron and other ores, sulphur and salt deposits, etc.), Potomac River and the head of Chesapeake Bay, by Dr. Hayden, Arnold Hague, S. F. Emmons, G. F. Becker, Captain Dutton, L. C. Johnson, and W J McGee, respectively. In other branches of the studies, the surveys have been continued under the several specialists who have had them in charge in pre-

vious years. The special papers contained in this volume—fruits of the division surveys already named—are: "The Rock-Scorings of the Great Ice Invasion," by T. C. Chamberlin; "Obsidian Cliff, Yellowstone National Park," by J. P. Iddings; "Geology of Martha's Vineyard," by Prof. Shaler; "Classification of the Early Cambrian and Pre-Cambrian Formations," by R. D. Irving; "Structure of the Triassic Formation of the Connecticut Valley," by W. M. Davis; "Salt-making Processes in the United States," by T. M. Chatard; and "Geology of the Head of Chesapeake Bay," by W J McGee.

PROFIT-SHARING BETWEEN EMPLOYER AND EMPLOYEE. By NICHOLAS P. GILMAN. Boston: Houghton, Mifflin & Co. Pp. 460. Price, $1.75.

THE wide extent which labor troubles have reached in the past few years, and the great loss and misery which they have caused, give importance to a scheme which promises to be in any measure a remedy for them. The present volume, which is the only recent work giving a comprehensive account of its subject, is devoted chiefly to a history of profit-sharing. Accounts of experience with the system in business houses of continental Europe occupy three chapters, the first of which is a sketch of "the father of profit-sharing," M. Leclaire, and his house. In the other two chapters the operation of the system in paper-making, typographical industries, cotton and woolen factories, iron, brass, and steel works, insurance, banking, and transportation companies, retail establishments, agriculture, and various other industries is described. A chapter is devoted to profit-sharing in England, and another to American experience with the system. Cases in which the system has been abandoned are grouped in another chapter, the reasons for abandonment being given in each case. The author has prefixed to this history an exposition of the present standing of profit-sharing, a brief introduction, a chapter on product-sharing, which is concerned with the conduct of agriculture, fisheries, and mining "on shares," and another on such aspects of the wages system as concern his theme. In two concluding chapters he gives a summary and analysis of the results which have been so far attained, and follows this with a statement of the argument for profit-sharing. The essence of his argument is thus stated: "Profit-sharing advances the prosperity of an establishment by increasing the quantity of the product, by improving its quality, by promoting care of implements and economy of materials, and by diminishing labor difficulties and the cost of superintendence." A bibliography of the subject is appended.

THE COMPLETE WORKS OF ROWLAND G. HAZARD. Edited by his Granddaughter, CAROLINE HAZARD. Boston and New York: Houghton, Mifflin & Co. Four Vols. Pp. 416, 410, 380, 504. Price, $2 a volume.

MR. HAZARD was a man engaged busily in manufactures and commerce, who found time to think of questions of political economy and metaphysics, and wrote well and vigorously upon them. While his discussions usually went back to fundamental principles and were rather abstract, those on economical subjects at least were practical enough to be applicable to questions of the day; and it is mentioned by Prof. G. P. Fisher that in the financial exigencies that arose during the civil war his observations were more than once influential upon the proceedings of Secretaries of the Treasury. He was born, of Quaker descent, in 1801, and lived, excepting thirteen years spent in Pennsylvania, at Peacedale, in Rhode Island, where he was engaged in the woolen manufacture. For ten consecutive years he traveled in the South, in the interest of his business. In the course of these journeys he took up the cause of Northern colored men who were detained at New Orleans in the chain-gang; and, having resolved to secure their release, may be said to have bearded the slave-power in its den and fought it victoriously in its own courts. It is illustrative of the condition of American thought and feeling at the time, that it was deemed expedient, when this matter was referred to several years afterward, to suppress the name of the chief actor, in order that he might not come too directly under public reproach. But Mr. Hazard regarded the episode as the greatest effort of his life. He died June 24, 1888, carrying his taste for the discussion of abstruse questions of metaphysics into the last hours of his life. Mr. Hazard's papers, which were first published as public addresses, in

periodicals, or in book-form—while some of them have never before been published—are grouped in these four volumes in as many sets, each having its distinctive character. In the volume containing the portrait and "Biographical Preface," the most important paper is on "Language," the first essay which the author produced, and one which, as he averred, contained the germs of all his writings. It attracted the attention of Dr. Channing, and was the origin of a lasting friendship between the two. Of the other papers the most notable are those on "The Adaptation of the Universe to the Cultivation of the Mind"; "The Bible," now for the first time published; "Intemperance"; "The Public Schools"; and "The Duty of Individuals to support Science and Literature." A second volume of "Economics and Politics" contains papers on public questions. The first of them, on the "Decline of Political Morality," is as good reading and as pertinent now as when it was spoken immediately after the election of the elder Harrison in 1840. The others were related to questions of their time, such as the "Fugitive-Slave Law"; matters concerning railroads and their charges; "The Tariff"; "Bribery;" "Hours of Labor"; and questions of finance and policy that arose during the war or have arisen since. A third volume comprises the book "Freedom of Mind in Willing," which was first published by D. Appleton & Co. in 1864. It was prepared at the suggestion of Dr. Channing, as an answer to the position of Edwards, and is preceded by an analysis by Prof. G. P. Fisher of the author's philosophical writings. The fourth volume contains the letters on "Causation and Free Will," which were addressed to John Stuart Mill, with their appendixes, the "Existence of Matter" and "Our Notions of Infinite Space"; "Animals not Automata," which first appeared in this magazine, and discourses on "Man a Creative First Cause."

SOME CHAPTERS ON JUDAISM AND THE SCIENCE OF RELIGION. By Rabbi LOUIS GROSSMANN, D. D. New York: G. P. Putnam's Sons. Pp. 190. Price, $1.50.

THE author attempts to sketch in this volume a few agreements which he discerns as already noticeable between historical Judaism and the present science of religion, leading up to the thought that the science of religion is the science of Judaism—or, as he otherwise expresses himself, that the results of the science of religion and the doctrines of Judaism overlap each other. He first aims to show that religion is intuitive, or that the religious feeling is native and common to all men; that it is spontaneous, by which is meant that the feeling, having been suggested by intuition, is made active and manifests itself in some form of personification. In the chapter on "The Universal Religion and the Sects," religion is treated as in some sort a growth and an adaptation. A distinction is drawn between religion and theology: "Religion is a child of our heart, theology is a creation of our mind. . . . Religion is eternal; theology a make-shift, which the exigencies of time and the compelling agents of Providence may throw into a useless heap." The relations of prophecy and the value of religious books are considered. The standard of morality, theories of ethics, and the relations of religion and knowledge, are discussed. The relations of Judaism are treated of under the headings of its history and the foreign elements in Judaism. The book is full of suggestion, but the peculiarities of its thought and style make very careful reading essential to the proper appreciation of it.

THE INDIANS: THEIR MANNERS AND CUSTOMS. By JOHN MCLEAN. With Eighteen Illustrations. Toronto: William Briggs. Pp. 351.

THE information embodied in this book is based upon a nine years' residence of the author as a missionary among the Blood Indians of the Canadian Northwest, and some facts of a historical nature have been obtained from other sources. Finding that many of the books about the Indians are of a sensational character, he has endeavored to write an account that should be reliable and at the same time interesting. A large number of topics are touched upon, including family, war, and social customs, religions, languages, legends, and traditions, modes of communication, and Indian oratory. Sketches are given of Tecumseh, Red Jacket, and other Indian heroes, and there is a chapter consisting of frontier tales of adventure. The author tells of the results achieved by the missionaries in Christianizing and civilizing the Indians, and gives his ideas on the Indian problem. "Hand, head, and heart training must go together," he says,

"in elevating the Indian race." Many respects in which the Indians are commonly misjudged are pointed out in this volume, and a large store of material is furnished from which an intelligent opinion of these people may be formed.

THE STORY OF HAPPINOLANDE AND OTHER LEGENDS. By OLIVER BELL BUNCE. New York: D. Appleton & Co. Pp. 188. Price, 25 cents.

THESE are nineteenth-century legends, or essays they might be called, for the embodiment of story in each case is subordinate to the thought which it contains. They are of a critical character, but far from being ill-natured or pessimistic, and are attractive in style. "The Story of Happinolande" calls attention very forcibly to the fact that the necessity of providing for our own wants is the only thing that makes us consent to supply the wants of others, and that without this necessity the industrial system of the world could not exist. In "A Millionaire's Millions" a would-be public benefactor is gradually forced to the conviction that, for improving the condition of the poor, ideas are more powerful than money, and that a stimulus to industry and economy accomplishes the beneficent purpose which almsgiving only defeats. Certain schemes and tendencies which have recently attracted public attention, especially in New York city, are also critically examined. "The City Beautiful" is an ideal, which will stimulate the reader to do his share toward realizing it; while the closing story, "John's Attic," is an ideal of a "home beautiful" adapted to moderate circumstances.

Prof. *David O'Brine* has published a second edition, rewritten, of *A Laboratory Guide in Chemical Analysis* (Wiley, $2). In its present form the book comprises, first, a chapter giving the preparation, tests, and uses of each of the reagents employed; next, a description of tests in the dry way, including those specially applicable to minerals. The tests in the wet way for the bases are then described, and there is a page on separation by electrolysis, which is followed by the methods for separating the acids. The next chapter comprises tables showing, first, the reactions of the bases, then those of the acids, with the usual reagents, which are followed by a brief summary of the leading laws and principles of chemistry. Methods for the examination of water and the detection of various poisons are given, and the closing chapter deals with general stochiometry.

The treatise on *The Lixiviation of Silver-Ores with Hyposulphite Solutions*, by *Carl A. Stetefeldt* (The Scientific Publishing Company), is offered to metallurgists as a clear, complete description of the lixiviation process in its most improved modern form. Special prominence has been accorded to the Russell process as practically standing for the lixiviation of to-day. The author deals first with the chemistry of the process, describing the chemicals used, giving the reactions of the sodium hyposulphite and the extra solutions, and telling in some detail the solubilities of metals and various compounds in sodium hyposulphite solutions. This part includes also the chemistry of the wash-water, and of sodium and calcium sulphide, and a chapter on laboratory work. In the part of the volume devoted to the practical carrying out of the process, a minute description of the arrangement of the plant is given, with detailed drawings, dimensions, and estimates of the cost of erecting and running the mill. The making of the solutions, the charging and discharging of the vats, the treatment of roasted and raw ores, and the precipitation of the metals from a lixiviation solution receive attention in turn. The closing chapter is a comparison of results of the Russell process with those of ordinary lixiviation and of amalgamation. The author reports that he has found it difficult to obtain correct statistics of the lixiviation process, but he expects to issue supplements that will place the statistics upon as sound a basis as the chemistry of the subject rests upon. The first of these supplements accompanies our copy of the work; it contains some corrections and results from the Yedras Mill, Sinaloa, Mexico.

The *Elementary Biology*, prepared by *R. J. Harvey Gibson*, M. A. (Longmans, $1.75), is a text-book adapted to college students. It opens with a brief summary of the principal conclusions of physics and chemistry, dwelling especially upon those laws on which biology immediately rests. Many speculations and explanations in re-

gard to the relationship of morphological and physiological details to general principles have been introduced, because the author is convinced that "working hypotheses not only serve to weave apparently isolated facts together, but give a certain vividness and interest to what would otherwise prove too often a bare and lifeless catalogue of data." He has made the botanical aspect of biology predominate over the animal in this book, because he deems the former from its simplicity more suited to elementary study, and because the latter has been abundantly treated by other authors. The book contains 192 cuts.

Among the late "Bulletins" of the United States Geological Survey are No. 40, on *Changes in River Courses in Washington Territory due to Glaciation*, by *Bailey Willis*, with maps; No. 41, *The Fossil Faunas of the Upper Devonian—the Genesee Section, New York*, by *Henry S. Williams;* No. 42, *Report of the Work* done in the division of *Chemistry* and *Physics* (1885–'86), by *F. W. Clarke;* No. 43, *On the Tertiary and Cretaceous Strata of the Tuscaloosa, Tombigbee, and Alabama Rivers*, by *Eugene A. Smith* and *Lawrence C. Johnson;* No. 44, *Bibliography of North American Geology for 1886*, by *Nelson H. Darton;* No. 45, *Present Condition of Knowledge of the Geology of Texas*, by *Robert T. Hill;* No. 46, *The Nature and Origin of Deposits of Phosphate of Lime*, by *R. A. F. Penrose, Jr.*, with an introduction by Prof. Shaler, and a bibliography; and No. 47, *Analysis of Waters of the Yellowstone National Park, with an Account of the Methods of Analysis employed*, by *Frank Austin Gooch* and *James Edward Whitfield*.

Of two recent geological essays by *W J McGee*, *Notes on the Geology of Macon County, Missouri*, embodies the results of a survey which was made preliminary to putting down a prospect bore; and *Dynamical Geology* relates to certain fundamental definitions growing out of the discrimination of processes commonly confounded but really distinct.

A little manual of *Deductive Logic* has been issued by *St. George Stock*, M. A. (Longmans, $1.25). The author remarks in his preface that one critic who examined his book in manuscript advised him not to publish it, because it was too like all other logics, while another advised him to cut out a considerable amount of new matter. He followed the latter advice, and hopes that he has at least escaped the guilt of wanton innovation. His object has been "to produce a work which should be as thoroughly representative of the present state of the logic of the Oxford schools as any of the text-books of the past." As a qualification for his task, he refers to seventeen years of study and teaching of the subject at Oxford. A collection of exercises is appended. The volume is made in a neat and convenient form.

The most noticeable characteristic of *Cram's Standard American Atlas of the World* (George F. Cram, New York, $10.50) is its unconventional handiness. On the front cover is an index of the United States, Canada, and Mexico maps, and the pages referred to here and in the full index inside the volume can be readily found, as the leaves are printed on both sides, either with maps or letterpress. The volume contains maps of all the States and Territories of the United States, which, it is stated on the title-page, "are the largest scale and clearest print of any atlas maps published." There are also maps of the various divisions of Canada, the other countries of North America, Europe and its countries, South America, Asia, Africa, Australia, and the chief island groups of the world, and twenty-two maps of American cities. Each State map is accompanied by an index of its towns and villages, with information in regard to location, population, post-offices, railways, etc. At the end of the book are twenty pages of "curiosities of statistics," and six pages of colored statistical diagrams. We have found with very little search a number of errors in its maps and its figures of population.

An American edition of *Sonnenschein's Cyclopædia of Education*, edited by *Alfred E. Fletcher*, is published by Bardeen ($3.75) It comprises a wide variety of pedagogical, psychological, historical, descriptive, and biographical articles, by such writers as Oscar Browning, J. S. Curwen, James Donaldson, Sir Philip Magnus, David Salmon, Arthur Sidgwick, and James Sully. A bibliography of education, occupying thirty-four pages, is appended.

A History of Education in North Carolina, by *Charles Lee Smith*, is published by

the United States Bureau of Education as one of its "Circulars of Information," among which it forms one of a series of "Contributions to American Educational History," under the editorial direction of Herbert B. Adams. In this essay, as Commissioner Dawson remarks, the writer has traced the genesis and development of education in North Carolina from the first settlement of that State to the present time; and for that purpose has examined the colonial records, the early laws of the State, works in public libraries, and private collections and personal correspondence, by the aid of which he has made a very satisfactory presentment of the story. While the history of primary and secondary instruction has not been neglected, the higher education has been principally treated in the sketch. The influence of certain classes of immigration and of institutions outside of the State is shown. Facts concerning noted educators are brought out. A full account of the University of North Carolina and of its influence on the South is given. In the picture of the present status of education in the State, we have been particularly interested in the story of what has been achieved since the war, and with the accounts of education among the colored people. One flourishing institution, Livingstone College, of the African Methodist Episcopal Zion Church, is wholly the product of their effort. The views of buildings, which are prominent in the volume, help illustrate how fast a hold the architectural idea still keeps in education.

Another of the Educational Bureau's circulars comprises a paper on *Industrial Education in the South*, by the Rev. *A. D. Mayo*. A general discussion of the conditions of American and Southern life leads to a consideration of the need of industrial training to improve those conditions, not only in the shops and on the farms, but in the home too; and to a review of the provisions that have been made to furnish such training. These seem to be good, so far as they have been made, to be distributed with fair evenness among the States, and to be afforded in such institutions as Tulane University and Washington University on a liberal and efficient scale.

Included in the *Proceedings of the Department of Superintendence of the National Educational Association*, at its meeting in Washington in February, 1888, are papers and discussions on "Manual Training in the Public Schools," "County Institutes," "Elocution," "Qualifications of Teachers," "Normal Schools," "Moral Training," "Can School Programmes be shortened and enriched?" "Alaska," the relations of "Superintendents and Teachers," and "National Aid to Education."

The *Massachusetts Society for promoting Good Citizenship* (Boston) issues as its first "Circular of Information" a report of the Committee upon Courses of Reading and Study on *Works on Civil Government*. The report contains a list of text-books recommended for schools, each accompanied by a descriptive and critical note, showing the scope and value of the book; a list of other text-books, with notes; a list of brief commentaries and similar books recommended; and a list of less valuable or more bulky commentaries and books of reference.

The fifth of the "Monographs" of the Industrial Education Association consists of a study, in the history of pedagogy, of *Aspects of Education*, by Mr. *Oscar Browning*. The author reviews the various shapes in which interest in education has manifested itself since the middle ages, with the factors which have influenced or worked to change them—ending with the present aspect, which he seems to regard as largely the following of Dr. Arnold's labors at Rugby School.

Hints for Teachers of Physiology, by *H. P. Bowditch, M. D.* (D. C. Heath & Co.), is No. 14 of the Boston Society of Natural History's "Guides for Science-Teaching." It furnishes suggestions for supplementing the instructions of the text-books by means of simple observations and experiments on living bodies or on organic material, for which teachers will need no other apparatus than is within their easy reach. Price, 25 cents.

The Training of Nurses, an address before the Michigan State Board of Charities and Correction, by Dr. *Hal C. Wyman*, gives a clear picture of what the ideal nurse should be, and of the manner in which she should perform the duties of her office.

The *Seaside and Wayside* series of readers, by *Julia McNair Wright*, has reached its third number (Heath, 55 cents). The present volume is similar in character to the

two which preceded it, the lessons dealing with plants, insects, birds, and fishes.

It inspires confidence in Mr. *Benjamin Y. Conklin's* text-book of *English Grammar and Composition* (Appleton, 75 cents) to find the author saying in his "hints to teachers": "In teaching grammar, it should never be forgotten that the real object is to teach pupils how to speak and to write the English language correctly, and how to read it intelligently. Analysis and parsing are only means to this end." The theory of the book is the gradual development of the sentence, beginning with its simplest form and adding new elements one after another. The learning of the proper forms which are required by the relations of words in sentences is deferred until the pupils have become familiar with the nature and office of the different parts of speech. The author states that he "has endeavored to avoid an excess of language-work on the one hand, and too much formal parsing and analysis on the other." The questions on the lessons are designed to cause the pupil to construct his own answers. Instead of the usual examples of false syntax, exercises are given for filling blanks in sentences by supplying the correct forms of the needed words. But, for teachers who desire to use the former, a collection is given in an appendix. The book is intended to compass the entire range of a two-book course.

PUBLICATIONS RECEIVED.

Archer, T. A. The Crusade of Richard I. 1189–'92. ("English History by Contemporary Writers" Series.) New York: G. P. Putnam's Sons. Pp. 388, with Plates. $1.25.

Baker, L. W., M. D., Baldwinville, Mass. The Infectious Diseases in their Relations to the Public Schools. Pp. 12.—How shall we deal with the Inebriate? Pp. 7.

Baker, T. Barwick Ll. War with Crime. New York: Longmans, Green & Co. Pp. 299. $4.

Cassell & Co., New York. "The American Workman." Weekly. Pp. 16. 5 cents; $2.50 a year.

Connecticut Agricultural Experiment Station. Annual Report for 1889. Part I. Pp. 48.

Cornell College of Agriculture. Agricultural Experiment Station. Bulletin No. 5, April, 1889. Pp. 20.

Crocker, George Grover. Principles of Procedure in Deliberative Bodies. New York: G. P. Putnam's Sons. Pp. 169.

Currier, Charles G., M. D., New York. The Efficacy of Filters and Other Means employed to purify Drinking Water. Pp. 42.

Dawson, George M. Notes on the Indian Tribes of the Yukon District and the Adjacent Northern Portion of British Columbia. Pp. 23.

Dolbear, Prof. A. E. On the Organization of Atoms and Molecules. Boston: Ginn & Co. Pp. 16.

Ebers, George. Margery (Gred): A Tale of Old Nuremberg. Translated by Clara Bell. New York: W. S. Gottsberger & Co. 2 vols. Pp. 279 and 300.

Egleston, T. Catalogue of Minerals and Synonyms alphabetically arranged for the Use of Museums. Washington: Government Printing-Office. Pp. 198.

Garner, R. L. Nancy Bet. (Verse.) Norfolk, Va.: "Landmark" Steam Printing-House. Pp. 18.

Goode, George Brown. The Fisheries and Fishery Industries of the United States. Sections III, IV, and V. Washington: Government Printing-Office. 4 vols., pp. 177, 178, 808, 881, and Plates.

Gouge, H. A., New York. Air: Its Uses and Abuses. How Perfect Ventilation can be secured under all Circumstances. Pp. 40.

Hague, Arnold, U. S. Geological Survey. Soaping Geysers. Pp. 10.

Hayes, Plym S. Electricity in Facial Blemishes. Chicago: W. T. Keener. Pp. 128.

Howe, William W. Municipal History of New Orleans. Baltimore: Johns Hopkins University. Pp. 88. 25 cents.

Huebsch, Samuel, New York. Pükeds de Solomon. (Proverbs of Solomon in Volapük.) Pp. 42.

Illinois Sixth Annual Report of the Board of Health. Springfield. Pp. 274.

Kaweah Co-operative Colony Company, Limited, Cal. A Pen-Picture. San Francisco: The "Commonwealth." Pp. 32.

Kunz, George F., New York. Precious Stones. Pp. 24.—Mineralogical Notes. Pp. 3.—On Two New Masses of Meteoric Iron. Pp. 4, with Plate.—Meteoric Iron from Arkansas, 1886. Pp. 8, with Plate.—Precious Stones, Gems, and Decorative Stones in Canada and British North America, exhibited at the Paris Exhibition, 1889, by Tiffany & Co., New York. Pp. 32.

Lloyd, J. Hendrie, M. D., Philadelphia. The Insanity of Oscar Hugo Webber. Pp. 5.

McComas, E. W., Fort Scott, Kansas. A Concept of the Universe. Pp. 38.

McGee, Mrs. Anita Newcomb, Secretary. Organization and Historical Sketch of the Women's Anthropological Society of America. Washington, D. C.: The Society. Pp. 22.

Massachusetts State Agricultural Experiment Station, Amherst. Analysis of Commercial Fertilizers. Instructions. Pp. 4.

Mays, Thomas J., M. D., Philadelphia. Alcoholism and Pulmonary Consumption. Pp. 10.

Merriam, George S., Editor. The Story of William and Lucy Smith. Boston: Houghton, Mifflin & Co. Pp. 666. $2.

Michigan, Agricultural College of. Experiment Station Bulletins, 39, 47, 48 (Insecticides, Silos and Ensilage, and Horticultural Department). Pp. 16, 45, and 27.

Montague, F. C. Arnold Toynbee. Baltimore: Johns Hopkins University. Pp. 70. 50 cents.

Moses, Bernard. The Establishment of Municipal Government in San Francisco. Baltimore: Johns Hopkins University. Pp. 83. 50 cents.

O'Connor, William D. Mr. Donnelly's Reviewers. Chicago, New York, and San Francisco: Belford, Clarke & Co. Pp. 101.

Ohio Agricultural Experiment Station, Columbus. Bulletin No. 8, Series 2 (Insects and Insecticides). Pp. 19.

Packard, A. S. The Cave Fauna of North America, with Remarks on the Anatomy of the Brain and Origin of the Blind Species. National Academy of Sciences. Pp. 156, with 27 Plates.

Parker, Francis W. How to study Geography. New York: D. Appleton & Co. Pp. 400. $1.50.

Phillips, Henry, Jr. An Attempt toward an International Language. By Dr. Esperanto (Warsaw, Russia). New York: Henry Holt & Co. Pp. 56. 25 cents.

"Public Health." Supplement, giving Minnesota statistics.

Riley, C. V. Insect Life. Vol. I, No. 9. Washington: Government Printing-Office. Pp. 36.

Shufeldt, R. W., M. D. Osteology of Arctic and Sub-Arctic Water-Birds. Pp. 30.—Osteology of the North American Anseres. Pp. 36.

Snyder, William L. The Geography of Marriage, or Legal Perplexities of Wedlock in the United States. New York: G. P. Putnam's Sons. Pp. 334. $1.50.

Starcke, C. N. The Primitive Family, its Origin and Development. New York: D. Appleton & Co. Pp. 315. $1.75.

Stowell, T. B. Syllabus of Lectures in Anatomy and Physiology. Syracuse, N. Y.: C. W. Bardeen. Pp. 118.

Thomas, Cyrus. Aids to the Study of the Maya Codices. Washington: Government Printing-Office. Pp. 100.

Todd, W. G., Editor. "The Teacher's Outlook." Monthly. Vol. I, No. 1. Des Moines, Iowa: Teachers' Publishing Company. Pp. 32.

Trent, William P. English Culture in Virginia. Baltimore: Johns Hopkins University. Pp. 141. $1.

Wentworth, G. A., McLellan, J. A., and Glashan, J. C. Algebraic Analysis, Solutions, and Exercises, illustrating the Fundamental Theorems and the most Important Processes. Boston: Ginn & Co. Pp. 418. $1.60.

Whitman, C. O., and Allis, Edward Phelps, Jr. "Journal of Morphology." April, 1889. Boston: Ginn & Co. Pp. 260, with Plates. $3 a year.

Winchell, N. H., State Geologist. The Geological and Natural History Survey of Minnesota. Report for 1887. Minneapolis. Pp. 501.

POPULAR MISCELLANY.

An Estray Wreck.—One of the most useful features of the monthly "Pilot Charts," published by the Hydrographic Office of the Navy Department, is the series comprising tracings of the courses of derelict vessels. It is said that between twenty-five and forty-five of these peripatetic dangers to navigation are recorded every month in the North Atlantic alone, and the supply is constantly kept up by the fruits of every great storm. Their wanderings are often very eccentric. Thus the W. L. White, a lumber-laden three-masted schooner, having been abandoned off Delaware Bay during the blizzard of March, 1888, started off to the southward under the influence of the inshore current and the northwest gale. Upon reaching the Gulf Stream she turned away to the eastward and began her long cruise toward Europe, directly in the track of thousands of vessels; drifting blindly about at the mercy of wind and current. During the former part of her wandering she followed a course about east-northeast, at an average rate of about thirty-two miles a day. From the beginning of May till the end of October she pursued an extraordinarily zigzag course, seesawing back and forth, and doubling upon herself, "staggering like a drunken man all over a comparatively small area, a constant menace to navigation in its most frequented ground." After escaping from this snarl, she moved east and northeast, 1,260 miles in eighty-four days, or an average of about fifteen miles a day. Finally, on the 23d of January, 1889, she was stranded on one of the islands of the Hebrides after a cruise of ten months and ten days, in which she traversed a distance of more than five thousand miles, and was reported forty-five times; while many more vessels may have passed dangerously near her at night or during thick weather.

The Canadian Lakes and the Glaciers.—In accounting for the origin of the great lake basins in Canada, Dr. Robert Bell regards Lake Superior as of volcanic origin, and Hudson Bay as having some points in common with it; while Athabasca, the Great Slave Lake, Lake Winnipeg, the Georgian Bay, and Lake Ontario, lie along the line where the limestones and sandstones meet the older Laurentian and Huronian strata, and were probably excavated by post-tertiary glaciers. Dr. Bell also points out that dikes of greenstones, etc., often formed the original lines along which the channels of rivers, arms of lakes, and fiords, were cut by denuding forces. Prof. A. T. Drummond suggests that the glaciers have been called upon to do too much work. There is difficulty in accepting the theory of such colossal glacial systems as geologists invoke. The vast effects of erosion by atmospheric and other agencies in Miocene and Pliocene ages which immediately preceded the Glacial epoch, and the great deposits of decomposed rock which must have accumulated during those ages, have been overlooked. The continental glacier, even if only a mile in thickness, of the extent demanded by the theory, would represent a depth of about five hundred or six hundred feet taken uniformly everywhere from the waters of the ocean and transformed into ice. The withdrawal of such a mass of water from the North Atlantic would have carried our coast-line from seventy-five to one hundred miles seaward, would have rendered the Gulf of St. Lawrence dry land and brought the Great Banks of Newfoundland to the surface, and would have obliterated the German Ocean. Are we prepared to ac-

cept these consequences? Prof. Drummond prefers a theory of great northern elevations of land creating mountain-chains and their glaciers, accompanied or followed by a depression farther south, which admitted the arctic currents, or perhaps formed an inland sea and a highway for icebergs bearing *débris* and bowlders, which they dropped on the bottom.

Orchids.—Orchids are commended by Mr. Frederick Boyle as pleasant room-ornaments, and clean, easily managed plants. "Observe my Oncidium," he says; "it stands in a pot, but this is only for convenience—a receptacle filled with moss. The long stem, feathered with great blossoms, springs from a bare slab of wood. No mold nor peat surrounds it; there is absolutely nothing save the roots that twine round their support, and the wire that sustains it in the air. It asks no attention beyond its daily bath." Sir Trevor Lawrence can see no reason, in the case of most orchids, why they should ever die. "The parts of the *Orchideæ* are annually reproduced in a great many instances, and there is really no reason why they should not live forever, unless . . . they are killed by errors in cultivation." Another authority says that, "like the domestic animals, they soon find out when there is one about them who is fond of them. With such a guardian they seem to be happy, and to thrive, and to establish an understanding, indicating to him their wants in many important matters as plainly as though they could speak." According to Mr. Boyle, the secret of orchid-culture lies in their indifference to detail "Secure the general conditions necessary for their well-doing, and they will gratefully relieve you of further anxiety; neglect those general conditions, and no care for detail will reconcile them." In Mr. Sander's orchid farm, at St. Albans, England, where three acres are occupied by orchids exclusively, growing in the most profuse luxuriance, no great pains are taken to exclude frost from the cool houses. It would be better to keep them at 50°, but the advantage does not equal the expense and inconvenience of warming such enormous buildings to the requisite degree. Mr. Boyle says that the "Indians of tropical America cherish a fine orchid to the degree that, in many cases, no sum, and no offer of valuables, will tempt them to part with it. Ownership is distinctly recognized when the specimen grows near a village." Mr. Roege has left a description of the scene when he first beheld the *Flor de Majo*. The church was hung with garlands of it, and such emotion seized him at the view that he choked. The natives showed him plots of this species acres in extent, where it was grown for the ornamentation of their church. A fine *Cattleya Morsiæ* in one of Mr. Sander's houses—the largest orchid of the kind that was ever brought to Europe—had grown upon a high tree beside an Indian's hut, and belonged to him, as it had belonged to his grandfather. He refused to part with it at any price for years, but was overcome at last by a rifle of peculiar fascination, added to the previous offers. "A magic-lantern has great influence in such cases, and the collector provides himself with one or more nowadays as part of his outfit."

Etching on Glass.—The object to be etched is immersed in a bath of melted wax, which on removal forms a thin coating over its surface. On this the designs are carefully scratched out by means of a pointed instrument, which removes the wax along the lines of the pattern. The glass is then immersed in a solution of hydrofluoric acid. The acid, which is very corrosive, attacks all the portions of the glass not protected by the wax, thus eating out the lines of the engraving on the glass. When this is done, all that remains is to clear away the wax. Owing to the destructive nature of hydrofluoric acid, a special room is kept, in which it is applied, the windows of which must be coated with wax, and the vessels used to contain the acid must be made of lead. Monograms and similar designs are printed in a kind of thick ink, on transfer paper, the lines of the monogram being left uncovered by the ink. The pattern is then transferred to the glass, the ink protecting the portions covered from the acid in the subsequent processes. As, however, the monogram only covers a small portion of say, a wine-glass or decanter, the rest is coated with wax. The bath of hydrofluoric acid is then used as before. The pretty zizzag patterns which so frequently adorn many wine-glasses are scratched on the wax by means of several ingenious machines.

One of the simplest patterns is produced by the tracing point rapidly revolving in a circle, while the glass slowly turns round on its axis. Another well-known pattern is traced out by a rather complicated mechanism, in which, by means of wheels having cogs along half their circumference, the tracing points are made to move up and down, and the glass to turn round, alternately, in a series of jerks. Although most of the patterns on glass are etched in this way, they lack the sharpness of definition required for the very best engravings. These latter are therefore carefully ground by hand, very small rapidly rotating wheels covered with fine rotten-stone powder being used to cut out the pattern on the glass. A large number of wheels of different shapes and sizes must be used for the various details of a complicated design, such as a bunch of flowers and fruit, and this method is only resorted to in the case of the most expensive dessert sets, as it involves a considerable amount of skilled workmanship. With regard to the embossed patterns, so common on butter-dishes and similar articles, these, as well as the lenses used in lighthouses, are formed by pressing the molten glass into molds of the desired form. The flutings and ribbings on decanters, and the familiar lozenge or diamond patterns on cruets, are carved on the glass by means of grindstones, whose edges are rounded, angular, or flat, as the case may be. In the preliminary grinding, rotten-stone and water are used, but for the final polish the finest putty powder is required.

Roman Wines.—The increase in late years of the wine production of the province of Rome has been attended with great improvements in the quality of the wine produced. The principal group of wine-making districts is that of the "Castelli Romani," the wines of which are robust and durable. The land is of volcanic origin, and the ancient Roman rules of cultivation are followed. The cultivation of the white grape is giving place to that of the black, with a corresponding change in the color of the wine. The wine is kept in caves that consist of long corridors or galleries hewn out in layers of tufa, and having lateral niches, in each of which a butt is placed holding between eight and twelve hectolitres. The caves are ventilated by means of wells, and even in the height of summer the wine is thus kept at a very low temperature. The Government exercises strict measures against adulteration; and this is held to include the addition of any substances that are not found in pure wine, or the use of which is not in accordance with the rational principles on which wine-making is based. The addition of substances naturally to be found in wine is also considered as adulteration, if the substances are beyond the just proportions existing in pure wines. An exception is made in the case of gypsum, for which the maximum quantity to be permitted is determined by the Superior Board of Health.

Lead-Poisoning.—Several cases of lead-poisoning, caused by the preparation of home-made wine in earthenware dishes coated with litharge glazing (oxide of lead) have recently been noted in the London "Lancet." The symptoms were the appearance of a bluish line around the gums, vomiting of bile in large quantities, obstinate constipation, and constant abdominal pains. On analysis of some cherry-wine, from the use of which one of the cases had arisen, lead, in the form of sulphate, was found in very dangerous proportions.

Getting to Sleep.—Among the many recipes that have been given for overcoming wakefulness is one devised by a Mr. Gardner, and formerly celebrated in England, but now almost forgotten. It is to lie on the right side, with the head so placed on the pillow that the neck shall be straight; keeping the lips closed tightly, a rather full inspiration is to be taken through the nostrils, and the lungs then left to their own action. The person must now imagine that he sees the breath streaming in and out of his nostrils, and confine his attention to this idea. If properly carried out, this method is said to be infallible. Counting and repeating poetry are other means that have been recommended. Combing the hair, brushing the forehead with a soft shaving-brush, or fanning, are all good sleep-inducers, and might well be tried on sleepless children. To these may be added the Spanish practice of getting a baby off to sleep by rubbing its back with the hand. A sensation of dry, burning heat

in the soles and palms, which accompanies certain diseases in some people, is a cause of sleeplessness that will give way to sponging the parts with vinegar and water. Wakefulness is sometimes the result of lack of food, and a glass of cold water or pale ale, or the eating of a sandwich, will, by setting up activity in the abdominal organs, divert the superabundant blood from the head, thus removing the cause of the unnatural activity of the brain. One reason why the most gifted minds have frequently been afflicted by sleeplessness is because bodily exercise is too often neglected by people devoted to intellectual pursuits. For such persons there is no better soporific than muscular exertion, carried even, in extreme cases, to a sense of fatigue.

Criminal Responsibility of the Insane.—It is a difficult matter to define with anything like precision the point at which we should cease to regard crime as the result of depravity and begin to treat the wrong-doer as the victim of disease. Prof. C. J. Cullingworth, of Owens College, thinks that certain forms of insanity are not properly regarded in the practice of the English criminal courts. In 1843 the House of Lords obtained from the judges who had acquitted the murderer McNaghten, on the plea of insanity, the opinion that, "to establish a defense on the ground of insanity, it must be clearly proved that at the time of committing the act the party accused was laboring under such a defect of reason from disease of the mind as not to know the nature and quality of the act he was doing, or, if he did know it, that he did not know he was doing what was wrong." Ever since it was put forth, this test has been treated as though it were the law of the land. It is, however, far from satisfactory, in that it restricts mind to the intelligence, and ignores the emotions and the will. Now it is by no means unusual to find the disorder of the emotions and the will far greater than that of the intellect, and especially in the cases of those whom insanity is most likely to impel to criminal acts. It is a common experience in lunatic asylums to find that the very persons who are the most dangerous to themselves and those about them are the most intelligent inmates in the institution. This is not a purely medical view of the question. Sir James Stephen has said: "No doubt there are cases in which madness interferes with the power of self-control, and so leaves the sufferer at the mercy of any temptation to which he may be exposed. . . . I do not think that a person unable to control his conduct should be the subject of legal punishment." Here we are brought face to face with the fiercely disputed question whether there is or is not such a thing as irresistible impulse—that is, whether persons apparently sane, and at any rate free from obvious delusion, may be impelled to insane acts by a force that they can not control. "I can not deny that medical witnesses have sometimes pressed this doctrine of irresistible influence unduly; still, there are undoubtedly cases where the insanity reveals itself chiefly, if not solely, in acts of violence, the consequence of uncontrollable impulse. The popular notions that one man can recognize lunacy as well as another, and that it invariably betrays itself by definite and unmistakable symptoms, are altogether erroneous. In a lunatic asylum the raving maniac is an exception, the majority of the inmates being quiet, orderly persons, who present, so far as their outward appearance goes, little or nothing to distinguish them from other people. Probably no one visits such an institution for the first time without being puzzled to know which are the officials and which the inmates. Like other chronic disorders, insanity is apt to come on insidiously. A certain alteration of manner, a disposition to talk a little more or a little less than usual, an unaccustomed recklessness in expenditure, a tendency to be suspicious of those who have hitherto been implicitly trusted, a slight failure in business capacity—these may be all the symptoms that mark the departure from mental health, until one day the smoldering insanity breaks out in an act of violence. The analogy between epilepsy and those forms of insanity which are accompanied with sudden outbursts is a very close one. The causes that have been at work in each case have been cumulative in their action, and only when the accumulated irritation has reached a certain degree of intensity has there been any, or but the very slightest, outward indication of the gathering storm. The spectacle

of an epileptic seizure taking place suddenly in an apparently healthy person is one of such every-day occurrence that it scarcely excites any notice. But if a medical witness stands up in court and suggests that an atrocious and apparently motiveless act of violence was the insane act of the apparently calm prisoner in the dock, he is in danger of being ridiculed as a theorist."

A Practical View of Parks.—Lord Brabazon, at the Sanitary Congress held in York in September, 1886, defended the propriety of maintaining parks in large towns upon the broadest practical grounds. Such establishments, he held, should not be considered luxuries, but public necessities. For health is one of the first of necessities, and no expense should be spared, and no opportunity neglected, to increase the average standard of the nation's health and strength. If a people's average standard of vitality be lowered, that people will assuredly be handicapped in the race of nations by as much as that standard has been lessened. The health of the mind is largely dependent on the health of the body, and a nation can only as have much muscular power and brain force as may be the sum total of those qualities possessed by the men and women of which it is formed. It is an axiom of hygienic science that, other things being equal, the health of a population is in inverse ratio to its density. Hence the density of population in large towns should be offset by providing as much open space as possible in the form of squares, parks, and pleasure-grounds.

Dangers of the Laboratory.—A striking instance of the dangerous quests which enthusiastic chemists undertake are the efforts to investigate the yellow oily substance called chloride of nitrogen. This terrible explosive was discovered in 1811 by Dulong, who lost one eye and three fingers in a vain attempt to ascertain its composition. So powerful is it that when Faraday and Sir Humphry Davy took it in hand they provided themselves with thick glass masks to protect their eyes from flying bits of glass, and to some extent from the irritating vapors of the oil itself. Faraday was on one occasion stunned by a detonation of only a few grains of the compound, and bits of the tube in which it had been contained almost penetrated his mask. On another occasion Sir H. Davy was severely injured by the explosion of a few drops under the receiver of an air-pump. Since their time the precise composition of the oil has been a mystery. At last, however, Dr. Gattermann, of Göttingen, has succeeded in its analysis. He finds that the substance examined hitherto was impure, and that the extreme danger of handling it was partly due to that fact, and partly to the varying action of light. Any bright light, he has found, is enough to produce detonation—a discovery made by the sudden destruction of his apparatus by a stray sunbeam. Chemical research nowadays is apt to stray among the teeming pastures of organic chemistry, to the neglect of the old problems offered by the inorganic world, though the solution of these problems should enlist the highest efforts of experimental science.

Superstitions about Snakes. — Besides certain errors in natural history, imagination has vested snakes with some supernatural or uncanny qualities. Thus, they are in some places believed to know where buried treasures are deposited; to lie upon the gold in winter; and, while too wary to show themselves near their hoard in summer, to come out in the bright, warm days of spring and bask in the neighborhood of their winter quarters. At such times a wise man will not kill them, but will watch where they go, mark the place, and take measures to possess himself of the treasure. But the snake is supposed to fight wildly for his property; and there are feigned to be in the old mines of Italy winged serpents which never come into the open air, but haunt the vaults where anything of value is hidden. They live upon the scent of gold, and violently attack any one who forces his way into their domain. No one, it is added, has ever seen them except by torch-light, when they must have looked rather like bats. The house-snake in Carinthia is supposed to bring good luck to the house he frequents. The fatter he grows the fuller will be the stalls, the granaries and the kitchen. So he is not disturbed, but has a bowl of milk placed every morning and evening in the cellar where he lives. Some of these serpents are fabled

to wear a crown—a small circlet of gold set with strange jewels, that brings good luck to any one who finds and knows how to deal with it—otherwise it may bring more harm than good. When it or any other treasure is found, it must not be touched first with the hands, but a part of the clothing should be cast over it. A maiden should use her apron for this purpose, but a man may take his coat or even his pocket-handkerchief. If a hat or any part of the head-gear is used, the finder will go mad. These snakes are thought to have a queen who is far more terrible than they. A legend is current at Friedbach that, in the old days when it was vexed with snakes, a stranger, Fridelo, came along, and promised to relieve them, provided, if he should be killed, they would say a mass for his soul every year. He ordered a fire built around an oak-tree, under which he placed himself. As the fire burned, Fridelo began to sing, or whistle, or call, and the snakes rushed into the fire and perished. Finally, a white serpent appeared, passed the fire, and bore Fridelo to the fire on the other side, where both were consumed. The district was ever afterward free from venomous creatures, and in gratitude for the riddance a church was built where the tree stood, in which serpent masses are said.

A Church-going Dog.—A story of almost reasoning intelligence is told of a dog belonging to the Rev. R. Ashton, superintendent of an Indian school and pastor of the church at Brantford, Ontario. He attends the church with the ninety Indian children of the school, and rises and sits down with the congregation. One day when a stranger-clergyman had preached too long for the dog, he bethought himself of a method for closing the service: he would have the collection taken which he had associated with the end of the sermon. He ran to the boy who was accustomed to carry the plate, and gazed steadfastly in his face. Finding that no notice was taken of this, he sat up and "begged" persistently for some time. This also receiving no attention, he put his nose under the lad's knee and tried with all his strength to force him out of his place, continuing this at intervals till the sermon was concluded.

Agricultural Maxims.—In the new edition of Stephens's "Book of the Farm" the student of agricultural science is advised to enter upon his course early in the winter, because most farming operations are begun at that time. Two years are considered necessary for a thorough grasp of the subject, for he "can not understand the object of a single operation in the first year of his pupilage." Those who have not been bred upon a farm and who can afford it, will find it better to spend their time at an agricultural college with a farm attached, than with some "practical" man as a private tutor, who is not gifted with teaching abilities. Of the branches of science applicable to agriculture are named botany, chemistry, germs, zoölogy, entomology, geology, meteorology, mechanics, and engineering. Among practical hygrometric indications is mentioned the vapor issuing from the funnel of a locomotive steam-engine, "for when the air is saturated with vapor, it can not absorb the spare steam as it is ejected from the funnel, and hence a long stream of white steam, sometimes four hundred yards in length, is seen attached to the train. When the air is dry, the steam is absorbed as it issues from the funnel, and little of it is seen." Other signs of weather are drawn from the behavior of animals. According to the calculations given in this book, most plowing, including turning and time spent in occasional stoppages, is done at the rate of about a mile an hour; and "a ridge of no more than seventy-eight yards in length requires five hours and eleven minutes out of every ten hours for turning at the landings, with a ten-inch furrow-slice; whereas a ridge of two hundred and seventy-four yards in length only requires one hour and twenty-two minutes for turning—making a difference of three hours and forty-nine minutes in favor of the long ridge as regards the saving of time" in one day's work.

Distribution of Lakes on the Globe.—The distribution of lakes on the earth has been studied by Dr. Bohm, of Vienna. Assuming that lakes usually exist in groups, and their origin is connected with the glaciers, the author shows that there is a relation between their situation and their altitude. It seems proved that the height of mountain

lakes above the level of the sea, in going from the pole to the equator, rises as the snow-line rises. Alpine lakes are classified as valley lakes and mountain lakes. The former are generally of considerable extent. They occupy the bottoms of the valleys and form a horizontal zone among themselves, bounding the circumference of a former glacial region, where the currents of ice, at the moment of maximum congelation, could exercise their greatest action. The others are generally small and lie at great elevations, in the heart of the mountainous region; but they are also frequently present in numbers at a common height in each chain of mountains, where they indicate the last stage in the retreat of the glaciers. Mountain lakes have only an ephemeral existence, for the amount of detritus which they receive and the depth of their effluents contribute to their speedy disappearance. More than a hundred lakes have gone out in this way in the Tyrol during the last century.

Famines and Irrigation in India.—Mr. H. C. Danvers has summarized the histories of fifty-two famines in India, extending over a period of twenty-three hundred or twenty-four hundred years, of which thirty occurred in the historical period, and twenty-two within the present century. The earliest was between 503 and 443 B. C. Then a period of fifteen hundred years follows without a record, though not, doubtless, without famines. The year A. D. 1033 was remarkable for very extensive drought and famine, succeeded by a pestilence. The earliest famine in the Deccan occurred in the year 1200, and lasted twelve years. The distress of 1345 was caused, in part, by excessive taxation, by reason of which "the poor became beggars, the rich became rebels, and the farmers were forced to fly to the woods, and to maintain themselves by rapine. The lands were left uncultivated, and grain consequently became scarce, famine began to desolate whole provinces, and the sufferings of the people obliterated from their minds every idea of government and subjection to authority." The great Doorga Deerce famine of 1396 arose from a total want of seasonable rain, and lasted twelve years. In the famine of 1811, the Government sanctioned disbursements on account of ceremonies for rain to be performed in the principal pagodas in Cuddapah. In Kattywar, men sold their children for food, and many respectable and well-to-do persons poisoned themselves to secure release from the pangs of hunger; and others died from want of that grain which their riches could not purchase. The great famine in southern India, of 1876–'78, was the worst which has been experienced since the beginning of the century. It is estimated that five and a half millions more, out of one hundred and ninety million people, perished than would have died had the seasons been ordinarily healthy. Mr. Danvers anticipates great results in mitigating the evils of famine from the extension of the railroads, by means of which provisions can be speedily taken into regions of scarcity, and prices kept down. In the discussion in the Society of Arts upon Mr. Danvers's paper, General Rundal laid great stress on the economical advantages of systems of irrigation. The total sum expended on irrigation works throughout India was £24,500,000, while the total loss which the Government had sustained in successive famines was given as £23,500,000. The irrigation works returned more than five per cent net, but the sum hopelessly spent in trying to mitigate famine returned nothing, and ten million lives had been lost during the century. The Godavery works, after thirty-five years, had netted £1,400,000, or double the whole capital outlay; the Kistna works, after twenty-five years, had netted £281,000, which was, perhaps, half what they had actually cost. These two works irrigated 563,700 acres and 303,000 acres respectively. The Tanjore works were still more remunerative. Other works had not given so large visible returns; but they could not be called failures, because they provided security against future famines, and were otherwise economically beneficial.

Identification by Thumb-Marks.—Among other anthropometrical data, Mr. Francis Galton has secured the impressions in printer's ink of the two thumbs of many hundred persons, in order to determine the possibility of using that method in identification. He says that a minute investigation of thumb or finger marks shows an extraordinary difference in small though perfectly

distinct peculiarities. Neither is there any room for doubt that these peculiarities are persistent throughout life. This method of testing identity would be valuable in many cases. A writer in the "British North Borneo Herald," commenting on a lecture by Mr. Galton on this subject, has spoken of the great difficulty of identifying coolies either by their photographs or measurements, and said that the question how this could best be done would probably become important in the early future of British North Borneo. Mr. Galton believes also that the difficulty of identifying pensioners and annuitants has led to the loss of large sums of money annually. A method of taking the impressions which he has used with good success is as follows: A copper plate is smoothly covered with a very thin layer of printer's ink, by means of a printer's roller. When the thumb is pressed upon the inked plate, no ink penetrates into the delicate furrows of the skin; the ridges only are inked, and these leave their impression when the thumb is pressed on paper. Turpentine readily removes the ink from the skin. A simpler process is to slightly smoke a piece of smooth metal or glass, press the thumb upon it, and then make the imprint on a bit of gummed paper that is slightly dampened. The impression is a particularly good one, and is durable enough for the purpose.

Judicious Charity.—The giving of money to beggars has been condemned on many sides. To bestow food or clothing upon a certain class of mendicants is also mistaken charity. The former is only an incumbrance, to be thrown away at the first opportunity; and the latter often finds its way to the pawn-shop. To prevent blankets being pawned, a benevolent Scotch lady once suggested buying them in two colors, cutting them down the middle, and sewing a half of one color to a half of the other. The purpose of the gift or loan would be answered, while the blanket would be unavailable as a pledge. The poor who are most deserving of sympathy and aid require much searching out, and often, when face to face with those who fain would relieve, make the most of their miserable surroundings in order to conceal their poverty. Indiscriminate almsgiving should be avoided and organization adopted—not the organization which requires elaborately furnished offices and a staff of heavily paid officials, but that which consists of benevolent individuals who have time at their disposal, and the heart and means to give, co-operating with each other. In all cases the assistance afforded should be adapted to the circumstances of the case, and, wherever possible, assume the form of a loan in preference to that of a gift. Money should demand an equivalent of labor in some form: an out-building whitewashed, a fence mended, wood cut, coal put in, ashes or snow removed, or something else. Organization could provide common material for shirt-making at proper prices by starving seamstresses, even if the articles were subsequently sold at a loss or given away. In any case let something, however simple, be required in return, so as not to destroy what self-reliance remains to the recipients of the bounty.

Arrow-Poison.—A letter from Mr. H. M. Stanley, read recently before the Royal Geographical Society of London, contained an extremely interesting reference to the arrow-poison used by the natives on the lower Congo. Mr. Stanley says that several of his party, being hit by the arrows of the natives, died almost immediately in great agony. The poison was found to consist of the bodies of red ants, ground to a fine powder, and then cooked in palm-oil. This mixture was smeared on the arrow-heads; its poisonous effects are due to the formic acid which is known to exist in the free state in red ants. This acid is also found in the stinging-nettle.

Expression in Infants.—It is not probable that infants in their earliest days give expressions of pleasure, for such expressions are largely imitative. There is but little difference during the first days of life between the joyful and the sad, the intelligent and the stupid face. The child's feelings have to be called out by his experiences, and his means of expression caught from those around him. He has a few movements of reflex origin, and some that may be intuitive. According to the "Lancet," an agreeable perception or a feeling of satisfaction is necessary to the causation of a smile, while the number of sensations of a pleasurable sort

which are possible to a baby a few days old is very small, and a perception in the proper sense is beyond its capacity. "The being bathed or suckled does not cause it to smile, but its countenance expresses simple satisfaction, probably because of the absence for the time being of all uncomfortable feeling. Even sleeping infants a few days old lift the angles of the mouth in an incipient smile, if such it may be named. Very lively faces with dimples in the cheeks, but with closed eyes and other signs of sleep, are matters of common observation. On the twelfth day of life Preyer observed on the face of a waking infant most of the characteristics of a smile, though the mouth movements were imperfect. It was on the twenty-sixth day of life that he first observed all the signs of an intelligent smile in his own child."

The Nest of the Water-Spider.—The ways of the water-spider (*Argyroneta aquatica*) were described in M. Blanchard's article several months ago. A fuller account of the breeding habits of this arachnid is given by Mr. Joseph L. Newton in "Science Gossip." The author had placed several of the spiders in a tank, in which suitable plants were growing. All made themselves at home but one, which appeared restless. "For the first two days it quickly traversed from side to side, making repeated attempts to climb the glass to effect an escape, but eventually it settled down, and was soon busily webbing together in a diverging manner the pectinate leaves of the water crowfoot; then going within its leafy shade, . . . to weave its silken cocoon, or nest, in which, on the fifth day, 10th of June, through a small opening it had left unwebbed . . . could be observed the yellowish mass of eggs, surrounded with a glistening layer of air, distinctly separate from its still unfinished harbor. After a day or so of rest, it further extended the nest downward, in a bell or funnel form, until nearing two inches long; then closed the lower or wider portion, with the exception of two openings, one on each side, just to give leave of its exit or admission. This being completed, the mother could often be seen gracefully wending her way to the surface, and carrying down large successive bubbles of air, then carefully liberating them, one by one, in order to form a sufficient supply, in which it then remained for some days. From the end of the first week the eggs now gradually grew darker, and on July 1st, exactly the third week, the upper portion of the nest or cocoon was completely laden with young; when the large globule of air slowly began to diminish, and, on being exhausted, the mother seemed reluctant to find a further supply—as though she had done her duty. Here the young naturally became troubled, and in the fourth week were quickly parading the interior of the cell, apparently for escape, which they, through the course of nature, effected on July 11th; thus, in about thirty days, over forty young were actively playing their delightful and youthful part, each bearing its silvery bubble."

Annual Rings of Trees.—In regarding the annual ring as it is marked in different kinds and qualities of timber, Prof. Fernow says that there are to be taken into consideration the absolute width of the rings, the regularity in their width from year to year, and the proportion of spring wood to autumn wood. The spring wood is characterized by less substantial elements (vessels of thin-walled cells in greater abundance), while the autumn wood is formed by thicker-walled cells, which therefore appear of darker color. In the wood of conifers and in that of deciduous-leaved trees, in which the vessels (appearing as pores on a transverse cut) are most frequent in the spring wood, the annual ring is usually very distinctly visible; while in those woods which, like the birch, linden, maple, etc., have the pores (or vessels) evenly distributed throughout the annual ring growth, the distinction is not so marked. Sometimes the gradual change in appearance of the annual ring from spring to autumn wood, which is due to the difference of its component elements, is interrupted in such a manner that seemingly a more or less pronounced layer of autumn wood can be recognized, which again changes to spring or summer wood, and then finishes with the regular autumn wood. This irregularity may occur even more than once in the same ring. Such double or counterfeit rings, which can be distinguished from the true annual ring by a practiced eye with the aid of a magnifying glass, have led to the notion that the annual rings are not a true indication of age. The

cause of such irregularity may be sought in some temporary interruption of the vigorous functions of the tree, induced by defoliation, for instance, or by extreme climatic conditions—such as sudden changes of temperature, cold days followed by sudden warm weather, or droughts followed by rain. The absolute breadth of the ring depends on the length of the period of vegetation, and is affected by the depth and richness of the soil, and the influence of light upon the tree.

NOTES.

ACCORDING to the "Medecinische Presse," of Vienna, a Dr. Terc has found a cure for rheumatism in bee-stingings. Having found that every stinging is followed by a swelling up to a point when the body seems to have become hardened against further effect, he tried the stingings on a rheumatic patient. Upon saturating the patient's system with the bee-poison the rheumatism disappeared —not to return for a long time. Dr. Terc has applied his remedy in one hundred and seventy-five cases and has inflicted thirty-nine thousand stingings; and now keeps a colony of bees on his premises, to be employed in this work.

ACCORDING to a count by Dr. W. J. Beal, of the Michigan Forestry Commission, there grow wild in Michigan seventy species of indigenous trees and three exotics that have escaped from cultivation; and of shrubs, one hundred and fifty native and five escaped exotics.

A DICTIONARY of Volapük, compiled by Assistant Surgeon M. W. Wood, U. S. A., is announced by Charles E. Sprague, New York. It will contain more than three hundred pages, and will embody the additions and emendations contained in the fourth edition of Schleyer's dictionary. A peculiar feature will be the arrangement of the Volapük-English and English-Volapük parts on the same pages; each page containing a Volapük-English and an alphabetically corresponding English-Volapük part.

PERTINENTLY to the interest that is taken in testing the vision and color-sense of seamen, a writer in the "Lancet" urges the importance of accuracy of hearing in men of this class. During fogs, sounds are the only means vessels possess of giving notice of their presence, and the only means by which they may be warned against danger of collision. It often requires a nice ear to hear a distant fog-whistle, and a nicer one to determine from what direction it comes. Seamen are as liable to affections which will blunt the acuteness of their hearing as they are to faults of eye-sight.

HERE is another instance of how observation trips up *a priori* reasoning. A correspondent of "The Spectator" relates that some one wrote to an English paper to say that "blackbirds did not eat fruit because they liked it, but because they were thirsty, and recommended we should place pans of water on the gravel walks and so save our garden fruit. A cottager in Montgomeryshire, being told of this interesting fact, replied in the dialect of that part of the country: 'Dern the bruts! they cross the bruck to come to my geërding.'"

AN opinion is growing that bovine tuberculosis is frequently transmitted to the human subject by eating the flesh and drinking the milk of tuberculous cows. It is to be hoped that thorough boiling of the meat destroys the vitality of the bacilli, which are assumed to produce this disease, but we are not warranted in believing that roasting the meat, as usually practiced, will have that effect; and as milk is seldom boiled before being partaken of, it is clear that the milk of a tuberculous animal is unfit for food, and dangerous to life.

BRITISH North Borneo is fast approaching the state of a regularly organized colony, with a fine promise of prosperity. The territory has been divided into nine provinces, named after the founders of the company, and grants of land have been issued covering 475,289 acres, in five of the provinces, those on the coast having the preference. The grantees are mostly Dutch; and a large proportion of the land granted is intended for tobacco cultivation. The total area of the territory will probably be found to be more than 20,000,000 acres. The price of the land, originally one dollar an acre, has been raised to two dollars. Regular steam communication was instituted September 1, 1888, between Sandakan and Hong-Kong and Singapore.

A STORY is told in the Ohio papers of a railroad engine-driver who was suspended because the examining physician pronounced him deaf. He asked to be reinstated because, when on a moving engine, he could hear perfectly well. This was found, on experiment, to be the case. Prof. W. M. Williams matches this story with another, within his own observation, of a man who was painfully deaf in a quiet house, but "could hear ordinary conversation with perfect ease in a cab or railway-carriage, provided the jolting was considerable."

A "DICTIONARY of Universal Climatology" is announced as in preparation by the Observatory of Rio Janeiro, M. L. Cruls, director. It is intended to present methodically the climatological data of as great a number of places on the earth as is possible, reduced to uniform standards of notation and terminology.

M. CHARLES RICHET, editor of the "Revue Scientifique," Paris, is investigating heredity in man, and invites information from correspondents respecting remarkable instances of the transmission of powers.

"VEGETABLE MUSK" is made from the seeds of the *Hibiscus abelmoschus*, a malvaceous plant. The ancient Egyptians used to chew the seeds to stimulate their appetites and make their breath fragrant, and they regarded them as aphrodisiac and astringent. Previous to the French Revolution, when it was the fashion to powder the hair, the seeds, called *ambrette*, were mixed with starch and kept till the starch had absorbed a suitable proportion of their perfume, when the seeds were removed and the musky-odored starch was put up in packets for sale. Ambrette is now imported in large quantities into Europe, and is used in the preparation of the alkermes of Florence, and to adulterate musk.

"How Sea-Birds dine" is described in "Nature" by a correspondent who caught them in the act off the island of Mull. Observing them collected at a single spot, he steamed toward it, and found that the center of their gathering was a reddish-brown ball, about two feet under the surface, composed of herring-fry, which had been driven into that shape by the divers surrounding the shoal and hemming them in on all sides, "so that the terrified fish huddled together in a vain effort to escape inevitable destruction. The divers work from below and the other sea-birds feed from above; and, as in some cases after the birds had been at work for some time I saw no ball, I suppose not one fish is left to tell the tale." The observation was repeated several times.

ASAYAMA, one of the most noted volcanoes in Japan, is the loftiest mountain in the country which is in a constant state of activity, and is nearest to the capital, and is also situated in a district that is famous for its health resorts. A correspondent who visited it describes the roar on approaching the edge of the crater as not unlike the noise produced by the passage of a railway-train across a bridge under which one is standing. There was no shaking, but loud hissing and bubbling constantly proceeded from numberless vapor-jets in the inner face of the crater-wall. The estimates of the diameter of the opening vary widely. The present crater is apparently the youngest and innermost of three.

THE important treatise of Buys Ballot on the distribution of temperature over the earth contains very plain cartographic representations of the variations of temperatures from means of the parallels and the difference between the temperatures of January and July. The least variations in the latter point are on the equator, and the greatest are in northeastern Asia (60°) and northwestern America (40°), and in the southern hemisphere, in Australia.

OBITUARY NOTES.

MR. ROBERT DAMAR, of Weymouth, England, a well-known naturalist and geologist, died May 4th, in his seventy-fifth year. He was an extensive traveler and assiduous collector. Among the collections he made were a series of fossil fishes from the cretaceous beds of the Lebanon, Syria; the most complete specimen of the extinct Steller's sea-cow, from Behring Island; and a series, called complete, of the fishes of the Caspian Sea. He had lately purchased the zoölogical collections forming the Godeffroy Museum in Hamburg, and had perhaps the largest collection in England of recent shells. He was the author of a work on the "Geology of Weymouth and the Island of Portland." He was contemplating, at the time of his death, another trip to Siberia, to procure an entire mammoth's skeleton.

AMONG recent deaths of scientific men in Europe are those of the Finnish botanist, Prof. Sextus Otto Lindberg; and Dr. Hermann Theodor Gayler, Director of the Botanical Gardens at Frankfort.

WARREN De LA RUE, F. R. S., an eminent English physicist, died April 19th, aged about sixty-three years. He was born in Guernsey and educated in Paris; was interested in photographic observations of solar eclipses and of the transit of Venus in 1874; was associated with Prof. Balfour Stewart and Mr. B. Loweny in the publication of "Researches in Solar Physics"; carried on a series of researches on the electric discharge, the results of which were communicated to the Royal Society and the French Academy; was for two years President of the Royal and for eleven of the Chemical Society, and for three years a member of the Council of the Society of Arts; and was a corresponding member of several foreign scientific societies.

PROF. FRANZ CORNELIUS DONDERS, of the University of Utrecht, a distinguished physiologist and ophthalmologist, died March 24th, in the seventy-first year of his age. He studied in the Netherlands Military Hospital School and the university, and was a professor at Leyden and afterward at Utrecht. He was the author of many works, among them an inaugural dissertation on "Harmony of Animal Life"; "Dutch Contributions to Anatomical and Physiological Knowledge"; "Metabolism of Tissue as the Source of the Proper Heat of Plants and Animals"; treatises in optics, including his great work on "Anomalies of Refraction and Accommodation"; and technical and special essays. He has been called the first surgeon who approached the subject of lenses as aids to vision in a truly scientific spirit.

ANTOINE LAURENT LAVOISIER.